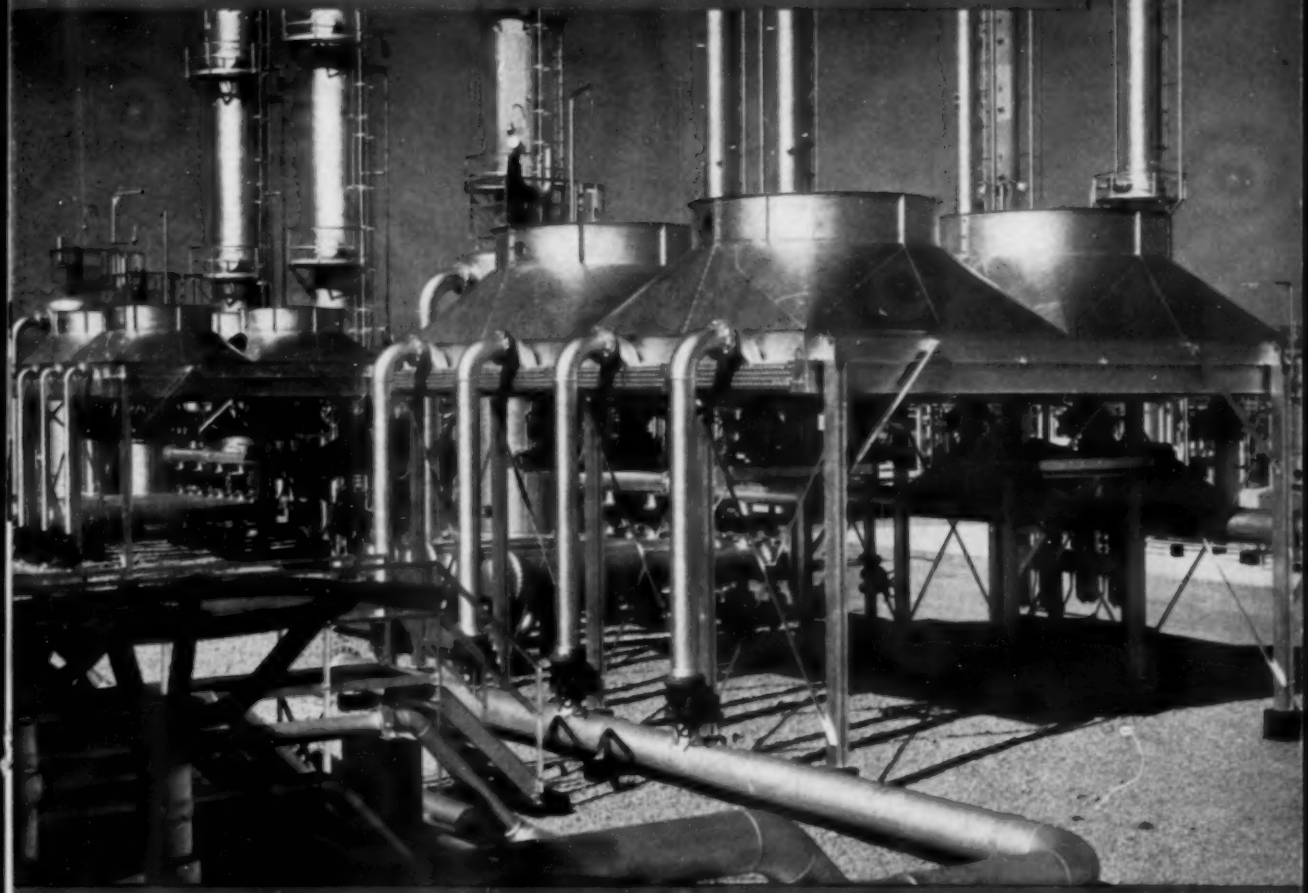
Petroleum Processing

PETROLEUM REFINING | PETROCHEMICAL MANUFACTURING | GAS LIQUIDS RECOVERY

DECEMBER, 1955



WANT TO SAVE WATER? — Take a look at air-cooling — p. 1901

OVER NINE MILLION—That's forecast b/d demand for '56 . . . . . p. 1877

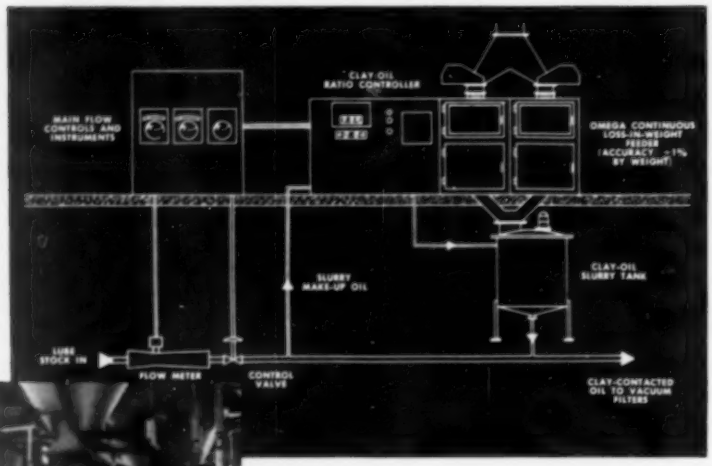
PURITY, SAFETY, SERVICE—the goal in a petrochemical terminal . . . p. 1882

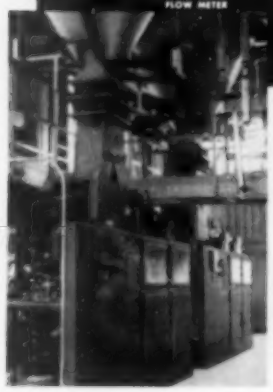
WHY USE JOB EVALUATION?—It has 'plus' values for you . . . . . p. 1899

A McGRAW-HILL PUBLICATION

B-I-F METERS FEEDERS CONTROLS

for the PETROLEUM industry

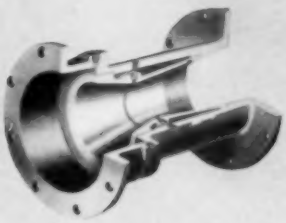




Continuous Clay Contacting

Omega, working with a refinery's consulting and contracting firm, developed this continuous clay contacting system for controlled decolorization of lube stocks. The complete system including controls, meters, Continuous Loss-in-Weight Feeder, hoppers, and slurry tank was furnished as a "package" – backed by Omega's engineering, manufacturing, and service organizations.

This system insures controlled proportional feeding of clay to oil for uniform dispersion and intimate contact, increasing efficiency of this process and reducing clay consumption. The proper ratio of clay to oil, as determined by chemical analysis and end-product specifications, is instantly obtainable by the twist of a graduated dial which reads direct in weight of clay per gallon of stock. The Omega Continuous Loss-in-Weight Feeder maintains this ratio independently of clay density variations, to insure a quality end-product.



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Flow responsive additive blenders

Chlorine Gas Feeders

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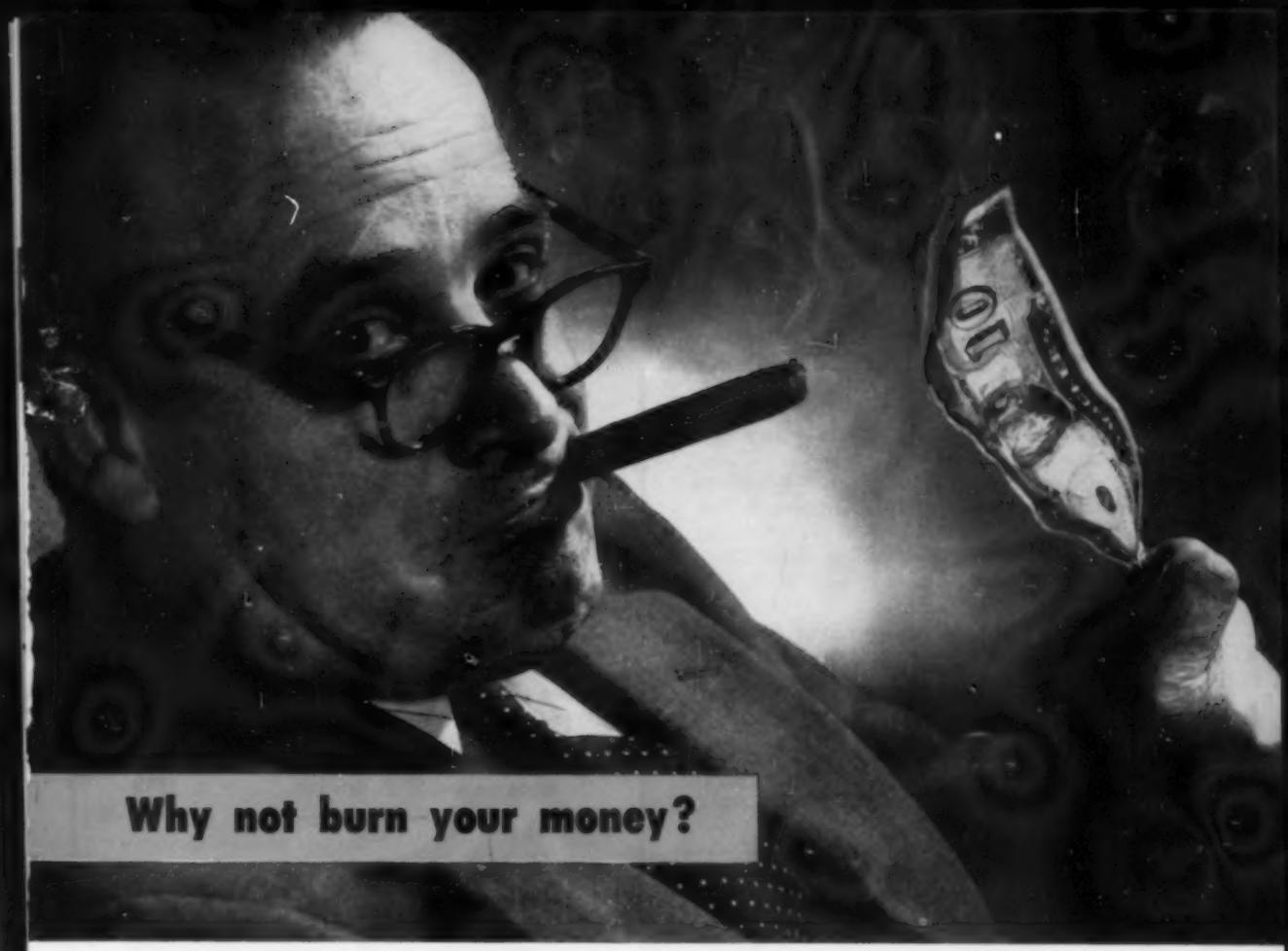

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At "Oilwell" *you get full value for every dollar*. Our completely stocked and strategically located warehouses serve as your own stores department. Service is always prompt—and you are saved the cost of maintaining large inventories.

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Quality products—"Oilwell" stocks include the best known brand names in equipment and materials designed and approved for refinery operations. When it comes from "Oilwell," you know it will meet your specifications.

Complete warehouse system—Well-stocked warehouses are conveniently located to serve the important refining centers. Inquiries are given prompt attention and deliveries are made quickly to meet your emergency requirements.

Experienced personnel—"Oilwell" refinery specialists, having been trained in refining and petrochemical plants, understand your material and service problems and can give you the service you require.

92 years of experience—From almost the beginning of the petroleum industry, "Oilwell" has worked with the men engaged in drilling and production. Our goal is to extend the same prompt, dependable and complete service to those responsible for Refining and Petrochemical operations.

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UNITED STATES STEEL

Reader's Guide

What's New in Petroleum

Over 9,000,000 Barrels a Day

That's where the 1956 demand on U.S. refiners for all petroleum products has been pegged. This is the annual outlook for next year as prepared by Petroleum Processing in a round-up of the industry's leading economists made by Virgil B. Guthrie.

Here Are the Highlights for 1956 over 1955:

Gasoline	UP	4.0%
Distillate Fuel Oil	UP	6.0%
Residual Oils	DOWN	0.2%
Lubricating Oil	UP	3.2%
Jet Fuels	UP	24.4%
All Products	UP	3.9%

Big influence on next year was an upsurge in the last half of this current year, well above the predictions of a year ago, and in line with the general picture for all industries.

For details, please turn to . . . . . p. 1877

I II 2 3 5

Are Your V-Belts Tight Enough?

Here are some helpful tips, in words and pictures, telling you practical ways to get the proper tension on your V-belt driven equipment. You don't need any fancy testing instruments but you can get a very accurate picture of your belt situation. By F. H. Rumble. **p. 1886**

I II III 3 4

Radiography — a Maintenance Tool

When it's used on jobs like checking lead linings in a sulfuric acid tower, radiography quickly indicates tiny defects and potential trouble spots not visible under conventional inspection methods. By W. Skiba and V. P. Bracken. **p. 1888**

I II 3 4

Better Instrument Maintenance

. . . can be yours if you centralize shop operations and reorganize the department. This is what Gulf Oil Corp. did with its outdated facilities at Port Arthur, Tex. Check this story to see what you might do to boost efficiency in your own plant. **p. 1890**

I II III 3 4

Purity, Safety, and Service

These are the three targets Celanese Corp. of America scored bull's-eyes on with their new petrochemical terminal at Newark, N.J. It will handle 50 different products from the company's Texas plants for shipment to customers on the East Coast. **p. 1882**

II 2 3 4 5

New Asphalt Classification System

. . . based on ultimate end use of the material rather than in terms of physical characteristics and properties. It's aimed at making production and sales data more useful, and is proposed by L. W. Corbett. **p. 1896**

I 3 5

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ABP ABC

Member of Associated Business Publications and Audit Bureau of Circulations

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Processing for December, 1955

PETROLEUM REFINING I | PETROCHEMICAL MANUFACTURING II | GAS LIQUIDS RECOVERY III | RESEARCH & DEVELOPMENT 1 | DESIGN & ENGINEERING 2 | PLANT OPERATION 3 | MAINTENANCE & CONSTRUCTION 4 | MANAGEMENT & PERSONNEL 5

Why Use Job Evaluation?

This is a management tool with plus benefits you may have overlooked. True, it aids in setting up wage structures and in controlling costs. But, it also will improve employe morale and worker productivity. **p. 1899**

I II III 5

How to Save Cooling Water

A problem of growing importance to the petroleum processing industries is conservation of water, as plants continue to move into drier locations. Here are two articles telling what operators have done in meeting and solving this problem. You'll want to read them both.

Run Compressors without Water

Natural gasoline plant compressor cylinders do not have to be water cooled. Sinclair Oil & Gas Co. cites its experiences over several years of successful operation with this trick, and explains why it seems to work so well. **p. 1901**

I II III 2 3 4

Use Combined Air-Water Cooling

For process cooling, air can be competitive with water, especially when there is a water supply problem. Cooling with a combination of air and water has resulted in remarkable savings in valuable water in the Pegasus natural gasoline plant at Midland, Tex. **p. 1904**

I II III 2 3 4

Jet Fuel Thermal Stability

Here is a practical, workable test for a jet fuel property which is becoming a critical problem. Du Pont has developed a simple technique which gives results that correlate well with full-scale results. By C. M. Barringer, M. W. Corzilius, and J. D. Rogers. **p. 1909**

I 1 3

What Are Your Disaster Plans?

Catastrophes can strike with lightning speed. When seconds count, it pays to be prepared – no matter what the emergency – enemy attack or the forces of nature. Here's how a research laboratory is planning to meet just such emergencies. **p. 1912**

I II III 1 5

Better Laboratory Productivity

Could you use a 50% increase in output from routine laboratory operators? Here's a successful way to get it, a system that worked for Tide Water Associated Oil Co. at Bayonne, N.J., as outlined and detailed in four steps, by David Rothbard. **p. 1914**

I II III 1 3 5

Your "Clip-n-File" Process Data

This new special department, perforated for quick and easy removal for your "do-it-yourself" process handbook. This month's subject: **p. 1929**

Butane to Butene and Butadiene By Catalytic Dehydrogenation

I II 2 3

DEPARTMENTS

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Continue "Readers' Guide" on p. 1923

HOW TO USE IT:

Your new "Reader's Guide to What's New in PETROLEUM PROCESSING" will do two things for you. First, the key numbers with each article will tell you at a glance if it is within your scope of interest; Roman Numerals indicate industries; Arabic Numerals, fields of activity. Second, the longer descriptions will tell you what each article is about, and why it can be of help and interest to you. –The Editors

ALUNDUM*

High-Purity Fused Alumina

How can you use it to advantage?

Among the many electrochemically refined materials produced by Norton Company, ALUNDUM fused alpha alumina is one of the most widely useful to industry. Thanks to its inherent properties of hardness, chemical stability and high density, engineers in various fields are finding many new applications for it.

Norton fused alumina is produced in a number of forms. Of these, 38 ALUNDUM* grain has proved particularly successful in applications demanding high purity. Electrically fused from Bayer-processed alumina, this white grain is shown by typical chemical analysis to be 99.49% pure Al_2O_3. It is insoluble in common solvents and extremely resistant to reduction. It is an amphoteric refractory and has high dielectric strength. Other characteristics include:

Melting point	**about 3600°F.**
Specific gravity	**3.94**
Crystal structure	**hexagonal system (rhombohedral division)**
Hardness	**9.0 Mohs' scale**
Index of refraction	**1.76 mean**

Typical Product Applications in which Norton high-purity fused alumina is now working out to advantage are:

For Catalytic Reactions. Norton fused alpha alumina carriers are outstanding for chemical stability and resistance to abrasion and erosion. Available in the form of spheres, rings and pellets they are used both in fixed bed oxidation reactions and as inert, low-density carriers for space filler applications where a low surface area (less than $1 m^2/gm$) is required. Other types of ALUNDUM catalyst carriers having surface areas in the range 5-60 m^2/gm are also available.

In Pebble Heaters. ALUNDUM heat exchange pebbles are giving excellent results in pebble heaters for heating gases above operating temperatures permissible in conventional tube furnaces. Their great resistance to abrasion, impact and repeated heating and cooling make them the ideal heat transfer medium in these devices. Also, their high refractoriness prevents them from the softening and "bridging" together that causes stoppages in the heater's moving bed.

In Thermal Cracking Reactors. Particularly in Wulff Process Generators for cracking light hydrocarbons to produce acetylene gas and Koppers-Hasche Generators for cracking light hydrocarbons to produce a variety of gases and petrochemicals — checkers made of Norton ALUNDUM high-purity fused alumina provide definite advantages. Their excellent heat transfer properties, high refractoriness and resistance to erosion caused by hot gases are important. Their ability to withstand the thermal stresses of intermittent operation assures long life. And their purity prevents side reactions with the reacting gases, thus safeguarding product quality.

In Gas Synthesis Generators. ALUNDUM fired shapes are ideal for lining generators of this type. Among the inherent characteristics of Norton high-purity fused alumina that work out very well are: high refractoriness, chemical stability, and inertness that prevents reacting with the contacting atmospheres.

Very many other uses for Norton high-purity fused alumina materials include: pure oxides and sintered refractories, refractory cements, wear-resistant parts, laboratory ware, coatings for rocket and jet plane parts and atomic energy equipment.

Other Norton Electrochemically Refined Materials

include CRYSTOLON* silicon carbide, MAGNORITE* magnesium oxide, NORBIDE* boron carbide, FUSED ZIRCONIA and many others, including a number still under development. These high-melting materials, which have varied applications in many fields, are also the basic ingredients of the famous Norton Refractory Rx's — refractories *engineered and prescribed* for the widest range of uses.

For Your Own Applications Or Developments

Norton Company not only supplies these materials in crude form, but has extensive facilities for processing and fabricating — and is ready to work with you in engineering materials to your particular requirements. A new booklet "Norton Refractory Grain — Electrochemically Refined" contains detailed information. For your copy, write to NORTON COMPANY, Refractories Division, 271 New Bond Street, Worcester 6, Massachusetts.

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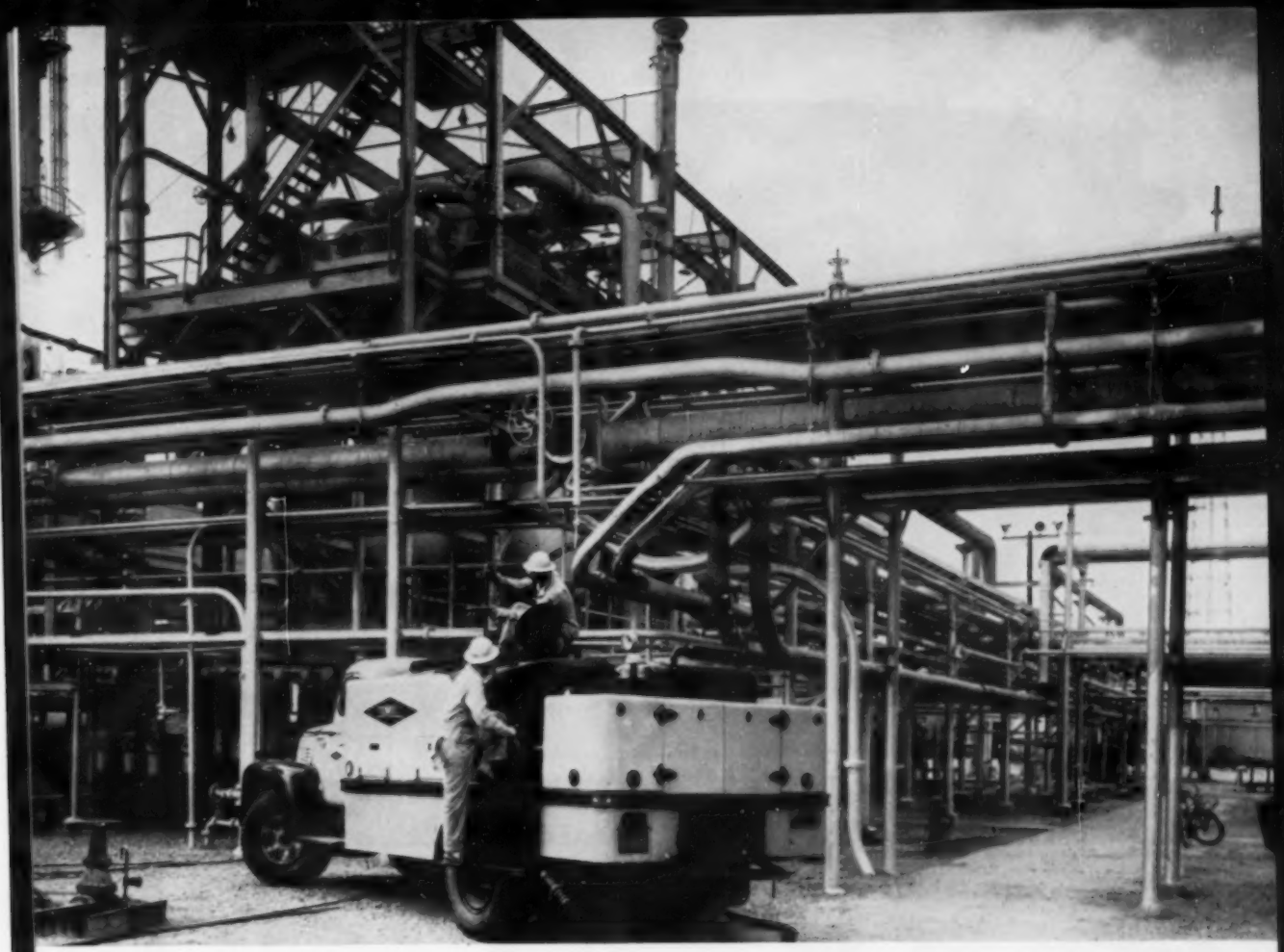

SAVED FROM CORROSION DEATH

DOWELL chemical cleaning avoided process line replacement

Replace a 7,000 foot system of 4 and 6 inch process lines, or remove highly corrosive deposits . . . this was the choice that faced the operator in this chemical plant.

His problem: The system carried ethylene glycol. Copper from heat exchangers and expansion joints, plus iron oxides and organic matter, had deposited in the system. They were causing serious corrosion which would eventually require line replacement.

His solution: He consulted Dowell. Dowell engineers tailored a three stage cleaning. With three specially designed solvents, they removed in turn the organic deposits, the iron oxide and associated deposits, and the copper. Lines were flushed with water and blown out with air after each stage.

His results: After chemical cleaning by Dowell, the operator inspected the lines. They were virtually 100 per cent clean with no trace of copper remaining. Because clean lines are less vulnerable to corrosion, he was saved additional capital investment.

Dowell engineers use solvents, pumps, sprays, jets, pigs and moles to clean all types of industrial equipment. Call Dowell for fast service. Offices and stations are located in major industrial areas. Or for more information, write Dowell Incorporated, Tulsa 1, Oklahoma, Department L-32.

chemical cleaning service for industry

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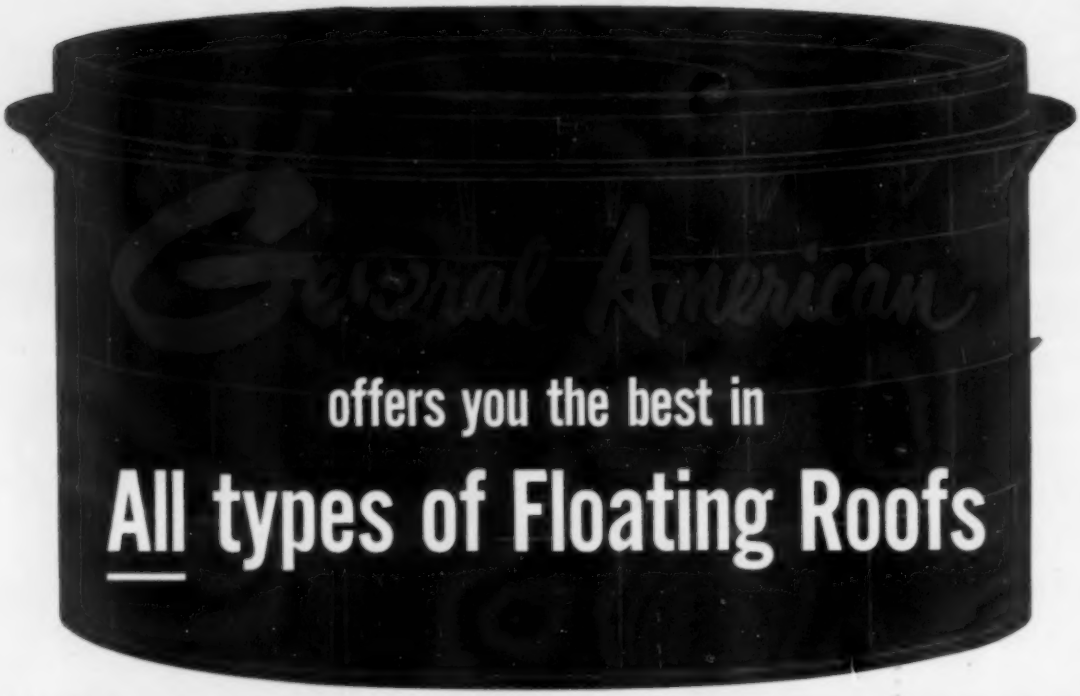

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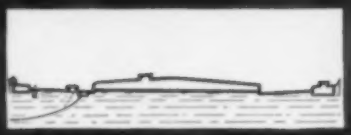

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Petroleum Processing

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We Have No Backyard Dump

TOO often, I fear, a reader gets the idea that the back end of a magazine is a sort of backyard dump—a place where the editors toss all the odds and ends that are left over. And in a lot of magazines it looks just like that is what is done. They're filled with the tag ends of stories stuck in between a hodgepodge of this and that.

But that's not the case in PETROLEUM PROCESSING at all. I and the rest of my staff think the back part of this magazine is just as important as the front part or the middle. We put a lot of information and material back there which can be of real help to you—and we put a lot of effort into collecting and editing it.

What you get out of it, of course, depends on how well you read it. We haven't figured out a system for pouring it into your noggin in some easy, painless manner.

But to save you time and to help you pick out the items that are of most value to you we have come up with a new gimmick. Last month we started a new "Reader's Guide to PETROLEUM PROCESSING Departments." It will be a regular item in each issue, and it will help you by highlighting some of the more important morsels of information which you can find back there. It's on pg. 1923 in this issue.

This "Guide" is something in the nature of "middle of the book" contents page for the regular departments which always follow our feature stories—our Process Data Sheet, Plant Practices, Personals, Coming Meetings, New Equipment, Editorials—to name only half of them. We'll still list all our departments in our complete "Reader's Guide" up front. But this new page will give you more details on what's in each particular one. It will be in the nature of a "refresher" course—something to help you get your second wind halfway through the issue.

Take a look at it—pg. 1923—and then plow into that backyard.

William F. Bland

Editor

PS: Speaking of helping the reader find information in PETROLEUM PROCESSING, there's something else brand new in this month's "backyard."

Bound in as part of this issue, beginning on page 1997, is the annual index for 1955. From now on, you will find the complete index of editorial articles and departments for the year just ending, in the December issue each year. This was done in response to a favorable vote during a readership poll we made last year. We hope this will make the index more useful to you.

Other McGraw-Hill Petroleum Publications

National Petroleum News
The monthly magazine of oil marketing—news, prices, transportation, storage merchandising

Platt's Oilgram News Service
A daily independent oil-news reporting service issued from New York, Chicago, Houston

Platt's Oilgram Price Service
A daily independent oil-price reporting service issued from New York, Chicago, Houston

Petroleum Week
The industry-wide magazine—covering production, processing, transportation, marketing

. . . as corrosive as hydrochloric acid
. . . as critical as caustic soda
. . . as volatile as chloroform
as viscous as molasses
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Easy-to-handle liquids and problem liquids alike . . . they're all in a day's work for the men at General American terminals. Storage capacity of over half-a-billion gallons is available for any liquid that can flow through a pipeline.

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By maintaining liquid inventories at General American terminals, you can fill rush orders for your customers or meet your own needs quickly, efficiently and economically.

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Terminals located at:

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Chicago, Illinois (Bedford Park)
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What's Happening

In Refining

. . . **Refiners will spend** $825-million next year to meet the 1956 record petroleum product demand of 9-million b/d. This is 13% more than the amount spent this year.

The oil industry as a whole will spend $5.3-billion, 6% more than 1955. Total capital investment of American business will be up 13% over this year.

These are some of the conclusions of McGraw-Hill's fall survey of industry investment plans, and Petroleum Processing's annual forecast (appearing in this issue on pps. 1877-1881).

. . . **Southland Oil, of Dallas,** will build a 25,000 to 30,000 b/d refinery at Tampa, Fla. The $25-million plant will produce gasoline, jet fuel, asphalt and other products. Construction will start immediately.

. . . **Sioux Oil,** of Newcastle, Wyo., will use a 750 b/d Houdriformer to process the naphtha cut of its sweet Newcastle crude. Litwin Engineering, of Witchita, Kan. will build the unit.

Recent contracts awarded:

. . . **American Gilsonite** to Foster Wheeler for a delayed coking plant, and to Kaiser Engineers for a calcining plant and other facilities, at the new Gilsonite coke and high test gasoline plant at Grand Junction, Colo. Contracts are valued at more than $5-million. This is the first privately financed commercial project for making conventional petroleum products from a raw material other than crude oil.

. . . **American Oil,** of N. Y., to Ralph M. Parsons Co., for three units at its 35,000 b/d refinery still under construction at Hornsbyville, Va. Units are: 7,600 b/d Ultraformer, 7,600 b/d naphtha desulfurization unit, 15,000 b/d gas-oil desulfurization unit.

. . . **Cooperative Refinery Association** to Southwestern Engineering, of Los Angeles for construction of two units at its Coffeyville, Kan. refinery. Units are: 5,000 b/d Platformer, 3,000 b/d Unifiner.

. . . **Esso Standard's** Baltimore refinery will supply Fluid Coke to be used in Newark, N. J., as a fuel source for generation of electricity. This is first such application. Refinery's total output, 170 t/d, will be used, replacing about 750 b/d of heavy fuel oil.

. . . **Salt Lake Refining Co.** will make its South Davis County refinery Utah's largest when it increases its capacity 15% to about 4,900 b/d.

In research . . . Cities Service plans a center at Cranbury, N. J., to study product development in fuels and lubricants. Nuclear energy and radioactive tracer techniques will be used. Also studied will be lubrication requirements of automation. Completion is scheduled for fall, 1956.

Esso Standard has been granted a permit for construction of a $1.6-million office and lab building at the Esso Research and Engineering Center, Linden, N. J. Occupancy is scheduled for January, 1957.

Sinclair Research Laboratories is planning a radiation facility at its Harvey, Ill. center which will use uranium fission products estimated to be 5 to 6 times more powerful than others in similar use.

. . . **Canadian Petrofina's** 16,600 b/d Houdriflow cat cracker at its Montreal Refinery, and the **Cooperative Refinery Association's** 650 b/sd UOP Platformer at Scottsbluff, Neb., are now on stream.

. . . **Standard Oil of California's** Honolulu refinery has been conditionally approved by the Honolulu City Planning Commission. Acquisition of site is next.

in Petrochemicals

. . . **U. S. Industrial Chemicals** will build the first commercial plant for the production of isomers of sebacic acid (USI Isosebacic). Initial capacity of the Tuscola, Ill. plant will be 10-million lb/yr.

. . . **Firestone** will build a $30-million addition to its synthetic rubber operations in either Texas or Oklahoma. Company's Akron, O., and Lake Charles, La., plants will be expanded 35% and 50% respectively.

Petrochemical Briefs

. . . **Shawinigan Chemicals** will build a multi-million dollar polyvinyl alcohol plant in Massachusetts.
. . . **B. F. Goodrich Canada, Ltd.,** is planning a $3.5-million polyvinyl plant near Niagara Falls, Ont.
. . . **St. Paul Ammonia Products** will build a $16-million, 200 t/d ammonia plant near St. Paul, Minn.
. . . **Haskell Chemical** has plans for a $70,000 synthetic resins plant at Dumbarton, Va.
. . . **Canadian Industries** will put up a 200 t/d synthetic ammonia plant at Millhaven, Ont.
. . . **Canadian Gulf Oil** will build a 225 t/d sulphur plant at Pincher Creek Field in Alberta.
. . . **Hercules Powder** will build a polyethylene plant at Parlin, N. J. Expected capacity: 100-million lb/yr.

in Foreign Operations

. . . **European Notes . . BP Benzin-und-Petroleum** is building a 5,700 b/d Hydrofiner for desulfurizing diesel oils at its Hamburg refinery. **Ruhrchemie's** 280,000 t/yr mineral oil refinery in Oberhausen-Holten is now on stream. **Conoco, Westling,** and **Koppers** are plan-

ning an $80-million project to supply middle eastern gas to West Germany's petrochemical industry. **West German Shell** is increasing its capitalization by 15% to back up current expansion.

Esso Standard S.A.F. will install a 10,000 b/d fluid cat cracker in its refinery at Port Jerome, France. **Societe du Caoutchouc Butyl,** a consortorium of ten companies, will build a 21,000 t/yr butyl rubber plant, also at Port Jerome. The French government is considering a proposal by **S.A.R.L. Pechelbronn** to build a 4.8-million b/d refinery, and related petrochemical plants in Strasburg.

Neste Oy, the Finnish state-owned company has given an $8.5-million contract to the French company Fives-Lille for construction of a refinery at Naantali. **Raffineria Siciliana Oil Minerali** is increasing capacity of Sicily's only refinery by 8,000 b/d to 43,000 b/d. **Caltex Petroleum** will expand its refineries near Rotterdam. **Russia's** only Siberian refinery is now on stream—at Omsk. It's aiming for production of 1.4-million b/d.

. . . **U.K. Notes . . British Petroleum** will build an $18.2-million plant at its Kent refinery to produce 2,600 b/d of avgas. **Bitumen Oil Refineries** will build a $3.36-million motor gas and diesel oil refinery at Brisbane, Australia.

In petrochemicals . . . **Monsanto Chemicals, Ltd.** is planning a $1.4-million phthalic anhydride plant at Newport, England. **Shell Chemical,** which just brought its Liverpool epoxy plant on stream, will build a dodecyl benzene plant in Essex. Shell will also build two fertilizer plants in Thames Estuary. Cost: $30-million.

. . . **Middle East Notes . . Jordan** has asked **Comberemo,** a Dutch firm to submit a preliminary report on the 200,000 t/yr refinery it is planning to process Saudi Arabian oil. **Syria** has allocated $22-million so far toward establishment of a 20,000 b/d refinery, likely site is Homs. **Lebanon's** capacity increased when the **Mediterranean Refining Co.'s** second Platformer went on stream recently. Crude throughput increased by 2,750 b/d. **Iraq's** Bagdad refinery is now on stream producing 24,000 b/d. A $9.4-million lube oil plant will be added later by Foster Wheeler.

. . . **Carribbean Notes . . Pemex,** whose Tampico facilities suffered severe hurricane damage, will modernize now, rather than next year. The 80,000 b/d Ciudad Madero refinery will get a 12,000 b/d cat cracker, the 40,000 b/d Arbol Grande refinery will be completely renovated. Concrete piers are slated for the sea terminal.

Pemex has also completed new installations at its Minatitlan refinery: cost: $14.8-million. **Gonzales Chemical Industries** is planning a 42,000 t/yr ammonia products plant at Guanica, Puerto Rico. **Lago Oil and Transport Co.** will build a $3.2-million, 20,000 b/d refinery at Aruba, N.W.I. Contractor is Badger Mfg.

in Transition

. . . **Humble Oil** shareholders have authorized company adoption of new Texas Business Corporation Act, and amendment and restatement of the company's charter. Purpose is to widen Humble's activities.

. . . **Gulf Oil** and certain major stockholders of Warren Petroleum have agreed on basis of exchange of stock leading to Gulf's acquisition of Warren.

. . . **Refinery Engineering Co.** will be bought by Vitro Corp., an industrial firm, for about $2.5-million.

. . . **Barco Oil** will sell its Barnsdall, Okla. wax refinery and wax business to Petrolite Corp. of St. Louis if stockholders of the two firms approve.

. . . **Socony Mobil** will reorganize its foreign operations into a new wholly owned affiliate, Mobil Overseas Oil Co. Effective date is Jan. 1.

in Markets and Prices

. . . **The trend of oil prices** generally continues steady to higher. The late Fall period was marked by increases in California heavy crudes and Pennsylvania-grade crudes. In products markets, lubricating oils advanced 0.5¢ to 2¢ gal. generally. Distillates and heavy fuels were steady. And there were no signs of the usual seasonal easing in gasoline.

A boost, in amounts ranging up to 10¢ bbl., in California heavy crudes had been anticipated by the West Coast industry for some time. Aided by shipments of 10.1-million bbl. of residual to Atlantic domestic and foreign destinations in the first nine months of this year, California heavy fuel inventories dropped from 30-million bbl. in November 1954 to around 14.4-million bbl. currently.

Following the crude increase, California heavy fuel prices rose 15¢ to 20¢ bbl.; lack of open market offerings even at the higher prices turned buyers to other areas for supplies.

With a 15¢ bbl. increase posted by South Penn Oil Co., Pennsylvania-grade crude prices recovered all but 1¢ bbl. of the drastic cut made a year ago last May. Resumption of operations at struck plants (Pennzoil and Elk) placed heavy demand on producers.

. . . **Rise in lubricating oil prices** covered virtually all primary supply markets. Mid-continent quotations were up 1¢, with solvent refined bright stock at 21¢, and 200 vis. neutral 16.75¢. Gulf Coast prices rose 2¢ to 23¢ for bright stock and 19.5¢ for 200 vis. neutral. Pennsylvania bright stock and 200 vis. neutral advanced to 20¢ and 19¢ respectively.

Lubricating oil inventories held by refining companies hit a four-year low at 8.5-million bbl. in August, according to Bureau of Mines Report. At this level, inventories were down 24% from recent year peak of 11.2-million bbl. reached in January 1953.

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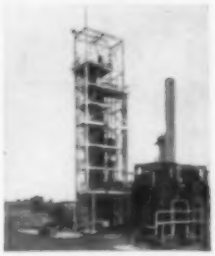

On July 30, 1955, Lummus turned over to Canadian Petrofina, Ltd., the 16,000 BSD Houdriflow Catalytic Cracking Unit and the 3,000 BSD Hydrodesulfurization Unit built at their new Point Aux Trembles Refinery near Montreal.

Construction on these two units began late in April, 1954, with the client requesting that the plant be completed by September 1, 1955. Substantially ahead of schedule by March, 1955, Lummus and the client agreed to use an absolute minimum of overtime labor for the remainder of the project to allow simultaneous completion of other refinery facilities. Even so, the two units were completed ahead of schedule, at a cost below the original guaranteed maximum.

Lummus constructed the Catalytic Cracking Unit complete with a charge heater system, Fractionation Unit, and Vapor Recovery Unit. The Hydrodesulfurization Unit (built under Shell license) is the second of these units in the world (Lummus having completed the first at Stanlow, England early in 1955). An outstanding feature of these units is the electronic instrumentation for temperatures, pressures and flow rates, complete with digital indication and adapted to automatic print-out logging and graphic panels. This is the first electronically instrumented Catalytic Cracking Unit in this hemisphere.

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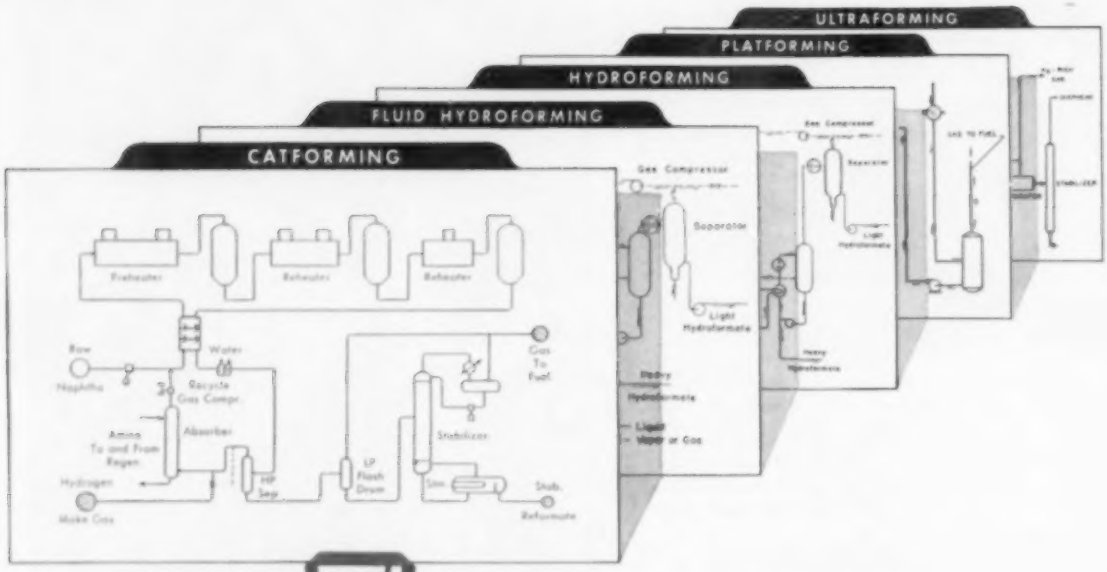

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FOSTER WHEELER

Industrial Preparedness May Serve Even in Minor Emergencies

MOST large oil companies have spent much time and money on plans to continue operating during and after enemy bombing attacks or other emergencies. Some smaller refiners have at least paper plans for operating during major disasters. Experience has shown that a "working" program has real value during local or minor emergencies, such as floods and storms.

The industrial preparedness program of the Esso Standard Oil Co. emphasizes before-hand planning to meet any abnormal situation which might arise. This program was described recently in Chicago.[1]

Esso pointed out that for any emergency, leadership is important in company functioning. So, it is essential to know individual skills outside of routine company duties. "This arrangement will provide good flexibility, through cataloging personnel for almost any type of emergency," it was said. Esso has this appraisal of leadership qualities in each plant.

Another Esso plan feature is emergency control centers away from the plant, stocked with office equipment and ready to operate in an emergency. Special care is given to telephone communication systems.

Control center location is important. The Esso plan often uses homes of executive plant personnel, since emergencies might stop traffic so that control center personnel would have to walk to centers.

The Esso program also keeps canned sterilized water supplies in offices and refineries. Refinery and marketing units are taught to decontaminate leaded gasoline containers for drinking water use. Recent experience in the New England floods showed that contamination of normal drinking water hindered relief work. Esso used this part of its preparedness program for tank truck water deliveries to drought stricken New Jersey communities last year.

"We pray that we may never have to use any of the industrial preparedness plans which have been set up. But if an emergency arises, we feel proper planning will minimize the disruption of our production and protect our personnel." Esso might have added that it will help them aid its communities when emergencies strike. (For another company's plan, see pp. 1919-13.)

—V.B.G.

(1) "Trends in Industrial Preparedness," Wilbur J. Reitze, Esso Standard Oil Co., before Quartermaster Assn. Convention, Chicago, Oct. 28, 1955.

Operations Research—A Way to Tomorrow's Decisions Today

NO one will deny that today the operation of refineries and petrochemical plants is complicated. The advent of new processes, fluctuating prices, new raw material sources, and many other variables make it tough steering for the man in the pilot's seat.

Important decisions must be made on the best information available. But when the scope of that information continues to grow . . . and Grow . . . and GROW, the unlucky individual faced with making sense out of all of it deserves sympathy, no matter what his salary. It is an old adage in leadership courses that any decision is better than none. But the payoff usually goes to the company making the right decision.

An increasingly important tool, though not a new one, is known as Operations Research. Those who worship brevity label it "O.R." Its accepted definition is apt to throw the uninitiated . . . but it means what it says: "Operations Research is the scientific study and analysis of management problems aimed at maximizing (or optimizing) the effectiveness of a company's overall operations."

Recent literature has included the names of oil companies among users of "O.R.," as befits this changing industry. The most recent example has been a report by Humble Oil and Refining Co.*

Humble has shown that everyday problems in the operation of a refinery lend themselves to this approach. Two initial problems they investigated were: (1) What is the optimum ratio of catalytic cracking to crude distillation capacity, when considering the optimum seasonal storage of gasoline and heating oil? and (2) What are the optimum oil storage capacity and related operations in the same refinery?

The first problem was tackled by a team of their own personnel, and the second problem attacked by an outside consultant. The solution to the first problem enabled Humble to define the answer in terms of: heating oil price, gasoline demand, summer and winter crude ratios, seasonal storage demands and transportational differences, and other variables affecting the right answer. The results of this analysis aided top management in making the correct decision on installing catalytic cracking capacity when added to their special knowledge of the company's position.

The answer to the second problem is not yet available. But there are intermediate results. The analysis has clearly shown that optimum operation of refinery equipment is dependent on the availability of crude storage, intermediate storage between process units and blending storage, and finished storage capacity. And also that the best storage setup is, in turn, determined by the optimum operation of the process units.

This "dog-chasing-its-tail" partial answer emphasizes again the strong interrelationship of all refinery operations. Not without considering all operations within the fence, can the optimum solution be found.

Recognition of this interdependence is not new. But there is now a method for relating all variables and arriving at the optimum solution for each. The ability to handle the numerous variables through a mathematical or model approach—and to do so quickly with an electronic computer—promises solutions to many apparently unsolvable problems.

Humble is already looking forward to other "stumpers" like optimum blending for motor and aviation gasolines, most efficient scheduling of maintenance work and workers, and the correct balance between

long and short range planning, trouble shooting, and process control functions for the technical section.

In adopting Operations Research, Humble, like others, does not consider that management is shirking part of its duties. Rather, they feel that this tool permits better application of known methods to arrive at the right decision. O.R. is definitely a valuable tool for solving the business complexities of the future.

—W.A.B.

* "Operations Research Activities At Humble," American Institute of Chemical Engineers, South Texas Section, Galveston, Texas, October 14, 1955.

NFPA Tentative Approval May Boost Inert Gas for Fire Safety

THE use of inert gases to prevent fires and explosions in vessels containing flammable fluids may find wider application in refineries, petrochemical plants, and some other sections of the industry.

The National Fire Protection Association recently gave at least an unofficial approval to the inerting principle in fire prevention. Full endorsement can come after NFPA decides to remove the "tentative" status.

Inerting is simply the adoption of the principle of excluding or reducing the oxygen to the point at which combustion cannot occur. For tanks this is done by introducing inert gases between liquid and tank roof to keep oxygen (air) from filling the space.

Another application of inerting is in purging process vessels of flammable vapors to prepare for cleaning, inspection, or introduction of fluids other than those previously contained in the vessels. This is a common practice at turnaround time.

Typical inerting gases today include carbon dioxide and pure carbon monoxide. Nitrogen, helium, neon, or argon can also be used but costs and other factors usually rule them out.

Inerting is not new. It has been used by at least one oil firm for over 25 years.

An official endorsement, however, by NFPA, would probably encourage wider use of the technique.

An advantage of purging with inert gas as compared to use of steam has been noted by Sun Oil Co., one of the pioneers in inerting. A vessel that has been purged with inert gases and ventilated can be entered almost immediately. This is not possible after steaming, partly because of the heat.

There are still some limitations in the use of inert gases. From an economic and a practical standpoint, some oil company safety engineers say that inerting systems are not needed generally in tank farms. Cost of installation is high for protection needed.

Another problem is keeping the inert gases free of moisture or constituents that might contaminate the material to be protected.

Whatever the current problems, Arthur F. Dunlap of Carbide and Carbon Chemicals Co., reporting on the approved tentative code at the National Safety Congress in Chicago in October, predicted that the use of inerting systems will:

1—Reduce personnel injuries, property losses, and production interruptions due to fires.

2—Possibly justify a lowering of insurance rates for risks where this type of protection is applicable.

3—Mean that instrument manufacturers could find a good market for oxygen indicators of the portable type, and for more reliable and less costly controls for permanent inert gas installations.

4—The need for other fixed protection systems will be reduced. —W.C.U.

Polyurethanes—Tomorrow's Big Petrochemical Development?

TIRES wearing five times as long, paint that can't be scratched by hob-nailed boots, and many other outstanding properties may make polyurethanes a big factor in future petrochemical production plans.

The polyurethanes—essentially glycol-adipic polyesters hooked up with diisocyanates—were first developed in Germany during World War II. They are formed by the reaction of diisocyanates with compounds containing two active-hydrogen groups. The diisocyanates serve as chain lengtheners and enter into cross-linking (with the aid of water) with glycols, diamines, amino alcohols, or additional diisocyanate. Other reagents being studied for the cross-linkage (curing) with diisocyanate include benzidine, naphthalene, toluene, diamines, phenols, aldehydes, nitro compounds, benzoyl peroxide, quinone oximes, chromates, and dichromates.

Outstanding physical properties of the polyurethanes include resistance to fire, oil, grease, solvents, temperature extremes, aging, weathering, abrasion, and laceration. Polyurethane rubbers have tensile strengths and load-bearing capacities superior to GR-S.

Foams, either rigid or flexible, are the number-one commercial use for polyurethanes at present, with Du Pont, Mobay, and Lockheed Aircraft controlling most of the basic patents and licensing business.

However, solid rubbers of polyurethanes loom in the not too distant future. Du Pont is now field testing their "Adiprene B," and Goodyear Rubber has tested their "Chemigum SL" in tire treads. Using about 18% polyurethane rubber in the tread has increased wear life 2-5 times over the best cold-rolled GR-S rubber.

Other competition from polyurethanes appears possible for polyethylene and cellophane films, various natural and synthetic rubber applications, coatings for magnet wires, paints, and even synthetic fibers.

There are several drawbacks to early production on a commercial scale. Diisocyanates are presently either imported or made by reaction of phosgene with an amine dissolved in a solvent, and therefore are still expensive. Special equipment and know-how are needed for making the foam polyurethanes, and the solid elastomer polymer mass becomes vulcanized too rapidly. Work is in progress to retard vulcanization.

—R.L.D.

Anon., *Chemical Week*, "New Life from Death Gas," July 4, 1953, pp. 50-53; "Blowing Up Polyester," May 15, 1954, pp. 68, 70, 72; "Isocyanate Probers Step Up the Pace," July 17, 1954, pp. 66, 68, 70; "Polyurethane Race; Foams Away First," Sept. 4, 1954, pp. 82-84; "Isocyanate Preview," July 2, 1955, pp. 39-40; "Dominant Triumvirate," Sept. 3, 1955, pp. 28, 30.

Letters

Thanks for the Story

To THE EDITOR: Congratulations on your excellent coverage of the "Whiting" fire story [October, pp. 1559-1569]. Speaking as an old refinery fire marshall: I do not believe that I have ever seen such informed comment on this subject before, certainly not outside a safety committee room.

Few refineries are ever built with a potential catastrophe in mind, the only one to my knowledge being Heysham in the United Kingdom. This was a wartime effort and there may have been some German equivalents. The cost is pretty horrible to budget-minded management and is generally unnecessary except under immediate threat of enemy action.

Normally, of course, all the necessary safety is built into each piece of equipment as such. This is really a piecemeal way of doing it, but in the aggregate the total safety of the pieces plus intelligent management is sufficient. Few refinery fires get outside the unit or section in which they start.

An explosion is a case apart, especially such a one as occurred at Whiting. There is, however, food for top management thought in the tendency to bunch units and storage equipment too close together, especially in expanding refineries. New large refineries, preferably in open country, should, I believe, spread themselves more, and buy up an open belt around their properties. A town with its hazards will encroach soon enough.

There are many details of layout which need attention on the sites to preclude total disaster if something does happen. They are only too often ignored. You have pointed up some obvious ones in your article. From them and the photographs I am inclined to ask what happened to the water sprinklers on the tanks for example.

As for the cause—pending the result of the inquiry—I would hazard the guess that some hydrogen at pressure was accidentally released into an improperly purged vessel. Oxygen incidentally would have almost the same effect.

The resultant investigation should be of considerable interest to both operators and designers.

ALAN BRITTON
Room 2053
11 West 42nd St.
New York 36, N. Y.

(*Continued on following page*)

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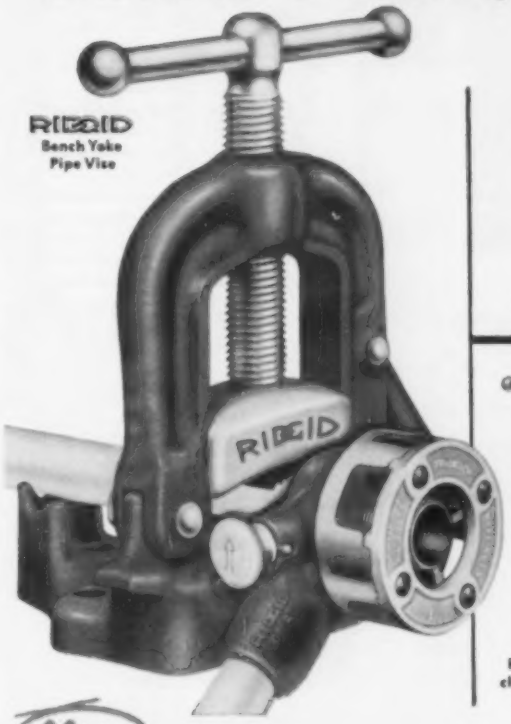

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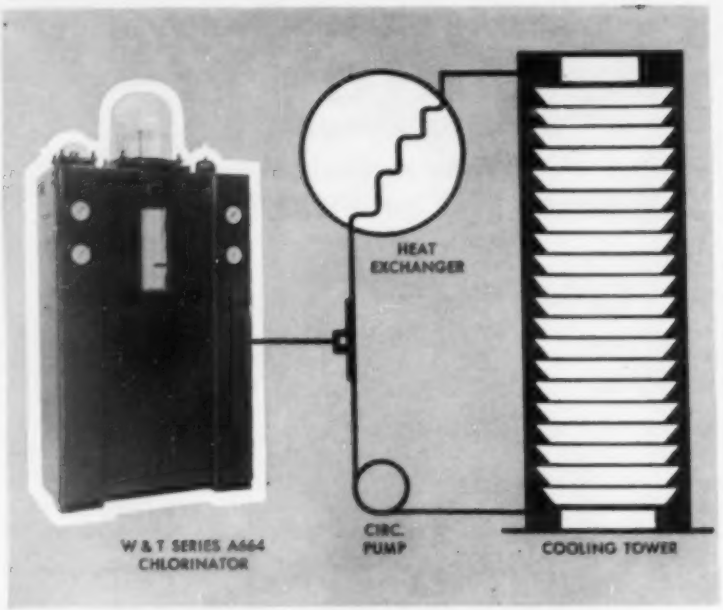
Slime Control...



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(Continued from preceding page)

Two Days Too Much?

To THE EDITOR: I am intrigued by a sentence in the table of contents of the October PETROLEUM PROCESSING which reads: "Two days later, PETROLEUM PROCESSING's Editor William F. Bland was on that story" (referring to the Whiting fire story).

I wonder what inference you want us readers to draw. Because of the journalistic tradition of getting on a story when it breaks, does the two-day lapse mean that PETROLEUM PROCESSING's editor waited until a hot story grew cold, or is the implication that he applied a gentlemanly journalistic approach?

FRANK BREESE
Editor
National Petroleum News
330 West 42nd St.
New York 36, N. Y.

• *The answer to Mr. Breese will be found in the following opening paragraphs of a memo Editor Bland wrote reporting on his project—and which was originally scheduled to be printed with the story but had to be omitted at the last minute:*

"Probably everyone in the industry knew about the fire . . . before I did. At 5:30 in the morning of the day it happened, my wife, three children, and I piled into the family Chevvy for a 561-mile drive to Wooster, Ohio. I planned to leave them there and spend the following week driving around Ohio, talking with readers of PETROLEUM PROCESSING.

"For some reason (probably because with three youngsters there was already too much noise) we didn't have the car radio turned on—and for some other reason (probably because we didn't stop very long at any one place) we didn't see any newspapers enroute.

"It wasn't until 8:30 Monday morning, two days after the fire, and while I was rolling along U.S. 30 headed for Findlay, Ohio, that I first heard of the disaster. I stopped in the next town, picked up a paper, and while bringing myself up to date over a cup of coffee, got the idea for the story I finally wrote.

"A quick telephone call to Indiana Standard—and that nicely planned Ohio trip was pushed to one side. . ."

Editor Bland was on that story.

DU PONT

PETROLEUM CHEMICALS DIVISION NEWS

DU PONT

December ★ One of a Series of Interest to the Petroleum Industry ★ 1955

Assistant Director of Sales

W. SAMUEL CARPENTER, III, was recently named assistant director of sales for the Du Pont Petroleum Chemicals Division.

Just prior to this assignment, Mr. Carpenter was director of manufacturing for the Cellulosics Division of the Textile Fibers Department. He joined the Du Pont Company in 1938 as an industrial engineer in the Engineering Department. In 1944, he was assigned to construction operations at Hanford, Washington, where the government's atomic energy project was built and operated by Du Pont during World War II.

When he returned to Wilmington in 1945, he was assigned to the Construction Division of the Engineering Department. The following year he became manager of that department's Planning Division and later manager of its Industrial Engineering Division.

In 1947, Mr. Carpenter was transferred to the Rayon Division as assistant to the director of production. And in 1949, he became assistant manager of "Cordura" high-tenacity rayon yarn sales. Then he was named assistant manager of the Rayon Department Planning Division in 1950.

Mr. Carpenter is a graduate of Princeton University in chemical engineering.

Construction under way on new Du Pont California tetraethyl lead plant

Approximately 200 local California construction workers are now busy erecting a new Du Pont tetraethyl lead manufacturing plant on a site near Antioch, California. Also completely integrated on the same site will be facilities for manufacturing Du Pont "Freon" refrigerants, sodium, ethyl chloride, trichlorethylene and perchlorethylene.

Architect's sketch of Du Pont's new integrated plant under construction at Antioch, California.

The official ground-breaking took place on August 24. Immediately following, the engineering and construction crews moved on to the site—which is in the Diablo Valley, approximately two miles east of Antioch on the San Joaquin River. Since then the work has been progressing at a rapid pace and the new TEL plant is expected to go on stream in 1956.

The fast-growing TEL requirements of the West Coast petroleum industry prompted the Du Pont Company's decision to build the plant in California. The convenient location of the Antioch site makes it readily accessible to both water and rail transportation.

Latest improvements

The new West Coast plant will house the most modern tetraethyl lead manufacturing facilities in the world. It will not only employ the new continuous process developed by Du Pont at the company's Chambers Works plant in

ADVERTISEMENT—Prepared for the Petroleum Chemicals Division of E. I. du Pont de Nemours & Company (Inc.)

OVER

DU PONT

PETROLEUM CHEMICALS DIVISION
NEWS

DU PONT

CONTINUED *California Plant*

New Jersey, but will also include many new refinements which make this modern process more efficient than ever.

Why the drilling rig?

Did you ever hear of anyone making a 7,000-foot hole in the ground with an oil drilling rig – yet hoping they *wouldn't* strike oil? That's what the Du Pont Company did on the Antioch site.

The hole will provide a means for disposing of brine wastes without any possibility of contamination of surface water or subterranean water resources. The well was "brought in" by the Brown Drilling Company in August, the first part of the new project to be completed.

Integrated production

Although the original Du Pont plan called for only the TEL and "Freon" manufacturing facilities at Antioch, the additional facilities for making other chemicals will add greatly to the efficiency of the over-all unit. This is because sodium and ethyl chloride are essential ingredients in the manufacture of tetraethyl lead.

Besides supplying intermediates for

Continued—middle of next column

TEL, the plant will also produce metallic sodium for Du Pont customers on the West Coast. It is widely used in metal descaling, especially for stainless steel. The trichlorethylene will go chiefly to West Coast aircraft and metal fabricating industries for degreasing metal parts. The dry cleaning industry is the chief consumer of perchlorethylene.

Due to the rapid expansion of West Coast industry, there is a definite need for the new California plant. And its establishment will enable Du Pont to give its West Coast customers the utmost in delivery service.

The three primary raw materials needed by the plant – lead, propane and salt – will be purchased locally. Propane, made from petroleum, will be brought into the plant from nearby refineries.

Creating new jobs

When completed, the over-all Du Pont facilities at Antioch will provide production jobs for some 500 people. The majority of these will be hired locally. At the peak of construction, about 500 workers will also be employed for building the plant.

ANOTHER DU PONT MARKETING SERVICE

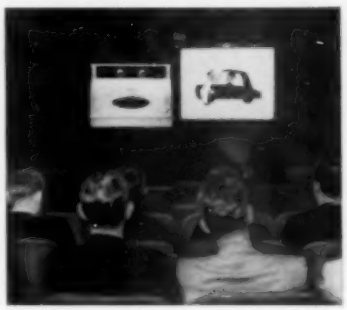
New "SELL YOURSELF" dealer training program offered

No matter how excellent the products he sells, a service station operator's success depends to a large degree on how well he sells *himself*.

But this involves *intangible* factors such as personality, friendliness, helpfulness. How, you may ask, can you impart such abilities to hundreds of individual and independent dealers? Actually the problem may not be as difficult as it looks on the surface.

To help you dramatize these factors and show your dealers how they pay off at the cash register, the Du Pont Petroleum Chemicals Division has prepared a unique 30-minute presentation. An animated, *talking* cash register acts as master of ceremonies. This is manually synchronized with a full-color animated cartoon movie.

It shows, in a very simple, easy-to-understand way, how any service station attendant can capitalize on everyday human relations. And it clearly demonstrates the selling power of personal neatness, friendly conversation and common courtesy.



The principal characters in the movie story are on-the-ball Joe Wright, a successful service station operator, and sloppy Joe Wrong, whose poor appearance and disagreeable attitude drive business away from his station. The simplicity of the story makes it unusually penetrating and convincing.

How soon would you like to make use of a "Sell Yourself" presentation in your own dealer training program? Any of our sales offices listed below will be glad to schedule it for you.

DU PONT

Better Things for Better Living . . . through Chemistry

Petroleum Chemicals

E. I. DU PONT DE NEMOURS & COMPANY (INC.) *Petroleum Chemicals Division • Wilmington 98, Delaware*

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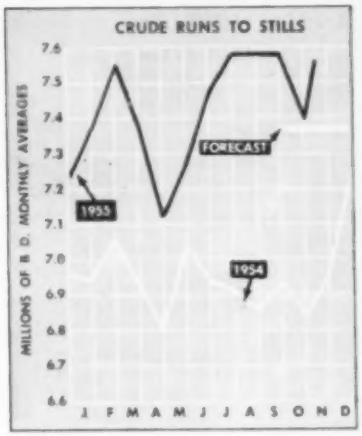
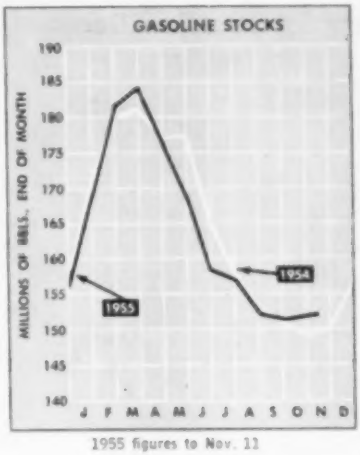
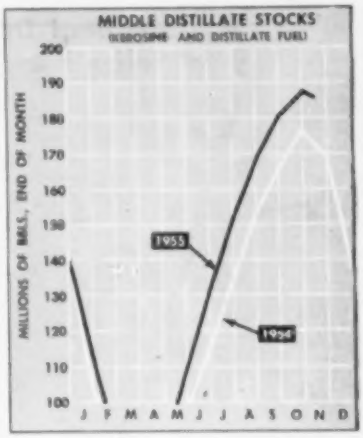






1955 figures to Nov. 11

Gasoline Output in High Gear

OUTLOOK: For refiners' gasoline inventories to reach 160,000,000 bbls. by Dec. 31.

PLANT operations are already stepped up to meet the overall 4% or better increase in product demand which has been forecast for 1956.

Also, to start the winter, refiners' inventories of gasoline and middle distillates Nov. 11 were 17,622,000 bbls. (nearly 6%) higher than Nov. 12, 1954. Residual stocks were 10,307,000 bbls. (18%) less.

Crude runs for the U.S. for 7 weeks through Nov 11 were 7,440,000 b/d avg., about 8% higher than for the comparable weeks in 1954. Excluding the East Coast, where the change was slight, crude runs were 9% higher than last year. Runs in the Okla.-Kans.-Mo. district were 12% larger. Thus plant operations in general have a good start on the stepping up that is normally anticipated during the early months of each winter.

Gasoline supply in October and early November was 3,800,000 b/d avg., 10% greater than last year. Forecast first quarter demand is 3,460,000 b/d avg. U. S. gasoline inventories, which for most of the summer were less than in 1954, started the seasonal fall and winter buildup early. Nov. 11 they were 152,084,000 bbls., over 4,000,000 bbls. (2.8%) larger than Nov. 12, 1954. Principal overages from a year ago were in the Okla.-Kans.-Mo. and California districts.

Distillate fuel oil production in October and early November was 1,572,000 b/d avg., about 3% larger than in the same 1954 period. Last quarter demand is forecast at 1,975,000 b/d avg., and for the first quarter of 1956 at 2,420,000 b/d avg. Inventories Nov. 11 were 150,606,000 bbls., 14,477,000 bbls. (10.6%) higher than Nov. 12, 1954. California is the only district where current stocks are less than a year ago.

Residual fuel oil output at refineries is 3% greater than last fall. Inventories in California Nov. 11, 14,525,000 bbls., are less than half what they were a year ago. East of California stocks Nov. 11, 31,236,000 bbls., were nearly 20% larger. In volume, however, they are small enough so that, in view of anticipated continuing low rate of refinery output and limitations on imports, light supplies are indicated for 1956.

NOVEMBER KEY STATISTICS

(Figures given in terms of millions of b/d, monthly averages, except stocks, which are in millions of bbls. at end of month)

	Nov. 1955*	Oct. 1955	Nov. 1954
CRUDE OIL			
U. S. Production	6.797	6.731	6.346
Imports	.722	.820	.636
U. S. Stocks	257.839	257.277	266.616
Runs to Stills	7.556	7.393	6.975
GASOLINE			
Refinery Output	3.719	3.723	3.428
Refinery Demand	3.791	3.799	3.505
Primary Stocks	152.084	151.777	150.604
MIDDLE DISTILLATES			
Refinery Output	1.943	1.866	1.976
Refinery Demand	2.108	1.606	2.246
Primary Stocks	186.368	188.186	168.433
RESIDUALS			
Refinery Output	1.131	1.108	1.120
Imports	.389	.320	.422
Total Supply	1.520	1.428	1.542
Refinery Demand	1.555	1.448	1.613
Primary Stocks	45.761	46.142	54.891

*Through Nov. 11.

PRODUCT AND CRUDE PRICES

Products—¢ gal., weighted average prices in principal refinery markets
Crudes—$/bbl., principal fields
Source—Platt's Oilgram Price Service

	Nov. 1955*	Oct. 1955	Nov. 1954
Gasoline	11.81	11.81	11.16
Distillate Fuel Oil	8.91	8.87	8.90
Kerosine	10.33	10.33	10.42
Residuals	4.84	4.79	4.06
Above 4 Products	9.21	9.19	8.65
Lube Oils	20.28	19.07	16.34
Crude	2.83	2.82	2.81

REFINERY YIELDS

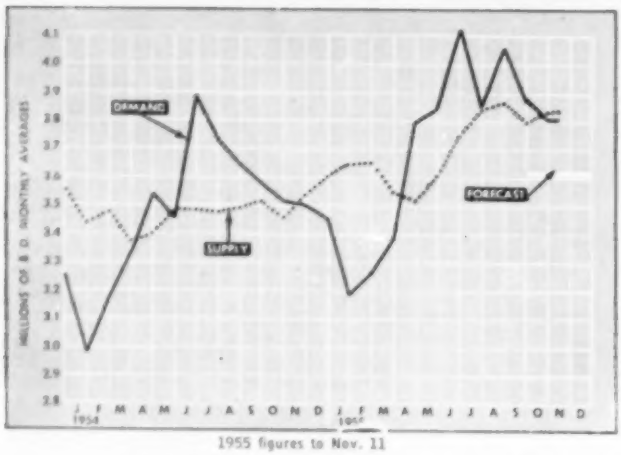
% on Crude Runs to Stills

	Nov. 1955*	Oct. 1955	Nov. 1954
Gasoline	44.6	45.6	43.4
Kerosine	4.3	4.1	5.0
Distillate	21.4	21.1	22.9
Residuals	15.0	15.0	15.8

*Through Nov. 11.

SOURCE OF DATA (except prices): Sept., Oct. and Nov., API weekly reports, earlier months, Bureau of Mines

Seasonal Drop in Gasoline Demand is Moderate

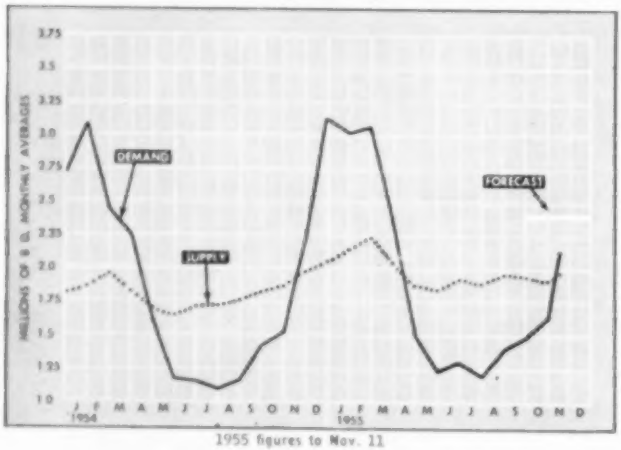


1955 figures to Nov. 11

MOTOR FUELS

	From Crude	From Nat. Gas	Total
SUPPLY (Millions of b/d)			
Oct. '55	3.373	.445	3.818
Oct. '54	3.019	.438	3.457
Change	+.354	+.007	+.361
% Change	+11.6	+1.6	+10.4
DEMAND (including Exports) (Millions of b/d)			
Oct. '55			3.799
Oct. '54			3.515
Change			+.284
% Change			+8.1
TOTAL SUPPLY (Millions of bbls.)			
10 Mos. '55	994.643	128.929	1,123.572
10 Mos. '54	924.313	127.190	1,051.503
Change	+70.330	+1.739	+72.069
% Change	+7.6	+1.4	+6.9
TOTAL DEMAND (including Exports) (Millions of bbls.)			
10 Mos. '55			1,131.566
10 Mos. '54			1,060.537
Change			+71.029
% Change			+6.7

Normal Upswing in Distillate Market Under Way

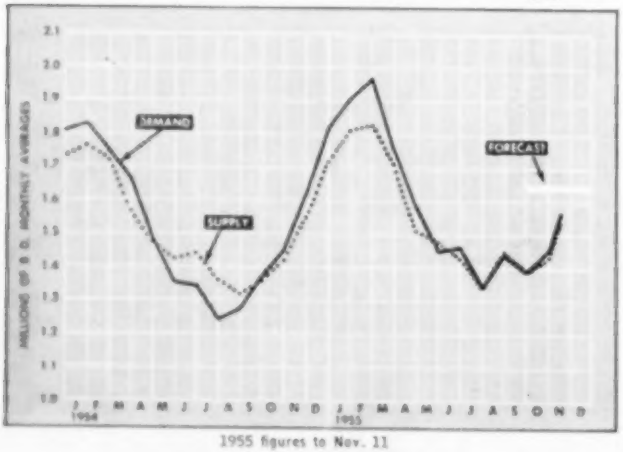


1955 figures to Nov. 11

MIDDLE DISTILLATES

	Kerosine	Dist. Fuel Oil	Total
PRODUCTION (Millions of b/d)			
Oct. '55	.304	1.562	1.866
Oct. '54	.310	1.545	1.855
Change	—.006	+.017	+.011
% Change	—1.9	+1.1	+0.6
DEMAND (including Exports) (Millions of b/d)			
Oct. '55	.303	1.303	1.606
Oct. '54	.308	1.205	1.513
Change	—.005	+.098	+.093
% Change	—1.6	+8.1	+6.1
TOTAL PRODUCTION (Millions of bbls.)			
10 Mos. '55	96.931	496.235	593.166
10 Mos. '54	99.890	441.894	541.784
Change	—2.959	+54.341	+51.382
% Change	—3.0	+12.3	+9.5
TOTAL DEMAND (including Exports) (Millions of bbls.)			
10 Mos. '55	87.726	454.834	542.560
10 Mos. '54	91.434	419.948	511.382
Change	—3.708	+34.886	+31.178
% Change	—4.1	+8.3	+6.1

Residual Fuel Oil Supplies are Limited



1955 figures to Nov. 11

RESIDUAL FUELS

	Refinery Output	Imports	Total
SUPPLY (Millions of b/d)			
Oct. '55	1.108	.320	1.428
Oct. '54	1.066	.360	1.426
Change	+.042	—.040	+.002
% Change	+4.0	—11.1	+0.1
DEMAND (including Exports) (Millions of b/d)			
Oct. '55			1.448
Oct. '54			1.448
Change			0
%			0
TOTAL SUPPLY (Millions of bbls.)			
10 Mos. '55	344.375	119.817	464.192
10 Mos. '54	346.358	104.398	450.756
Change	—1.983	+15.419	+13.436
% Change	—0.6	+14.8	+3.0
TOTAL DEMAND (including Exports) (Millions of bbls.)			
10 Mos. '55			475.233
10 Mos. '54			448.544
Change			+26.689
% Change			+5.9

SOURCE OF DATA: Sept., Oct. and Nov., API weekly reports, earlier months, Bureau of Mines

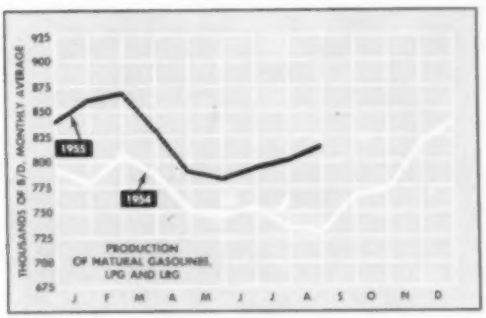
RUNS TO STILLS AND DISTRIBUTION OF PRIMARY STOCKS BY U. S. REFINERY DISTRICTS

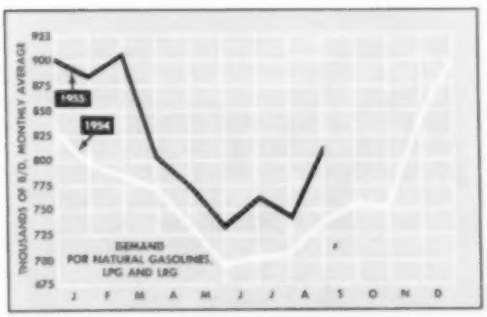
(Primary stocks include those at refineries, at large terminals and in pipelines; all data based on API reports)

District	RUNS TO STILLS (Millions of b/d average for week ending on date shown) Nov. 11 1955	Nov. 12 1954	Change	% Change	GASOLINE STOCKS (Millions of bbls. on date shown) Nov. 11 1955	Nov. 12 1954	Change	% Change	RESIDUAL STOCKS (Millions of bbls. on date shown) Nov. 11 1955	Nov. 12 1954	Change	% Change
East Coast	1.076	.966	+ .110	+11.4	36.063	34.297	+1.766	+ 5.1	13.106	10.635	+ 2.471	+23.2
Gulf Coast	2.602	2.304	+ .298	+12.9	28.346	29.428	−1.082	− 3.7	8.237	6.740	+ 1.497	+22.2
Total Coastal	3.678	3.270	+ .408	+12.5	64.409	63.725	+ .684	+ 1.1	21.343	17.375	+ 3.968	+22.8
Appalachian	.198	.155	+ .043	+27.7	6.783	6.605	+ .178	+ 2.7	1.010	.857	+ .153	+17.9
Ind.-Ill.-Ky.	1.291	1.272	+ .019	+ 1.5	30.797	31.470	− .673	− 2.2	5.055	4.245	+ .810	+19.1
Okla.-Kans.-Mo.	.698	.582	+ .116	+19.9	14.466	12.927	+1.539	+11.9	1.501	1.364	+ .137	+10.0
Other Inland	.618	.547	+ .071	+13.0	14.272	14.816	− .544	− 3.7	2.327	2.201	+ .126	+ 5.7
Total Inland	2.805	2.556	+ .249	+ 9.7	66.318	65.818	+ .500	+ 0.8	9.893	8.667	+ 1.226	+14.1
Total East of Calif.	6.483	5.826	+ .657	+11.3	130.727	129.543	+1.184	+ 0.9	31.236	26.042	+ 5.194	+19.9
California	1.070	1.057	+ .013	+ 1.2	21.357	18.353	+3.004	+16.4	14.525	30.026	−15.501	−51.6
Total U. S.	7.553	6.883	+ .670	+ 9.7	152.084	147.896	+4.188	+ 2.8	45.761	56.068	−10.307	−18.4

District	DISTILLATE FUEL OIL STOCKS (Millions of bbls. on date shown) Nov. 11 1955	Nov. 12 1954	Change	% Change	KEROSINE STOCKS (Millions of bbls. on date shown) Nov. 11 1955	Nov. 12 1954	Change	% Change	TOTAL MIDDLE DISTILLATE STOCKS (Millions of bbls. on date shown) Nov. 11 1955	Nov. 12 1954	Change	% Change
East Coast	57.406	52.132	+ 5.274	+10.1	15.008	14.646	+ .362	+ 2.5	72.414	66.778	+ 5.636	+ 8.4
Gulf Coast	22.914	22.353	+ .561	+ 2.5	5.942	7.315	−1.373	−18.8	28.856	29.668	− .812	− 2.8
Total Coastal	80.320	74.485	+ 5.835	+ 7.8	20.950	21.961	−1.011	− 4.6	101.270	96.446	+ 4.824	+ 5.0
Appalachian	4.421	3.549	+ .872	+24.6	1.259	1.222	+ .037	+ 3.0	5.680	4.771	+ .909	+19.1
Ind.-Ill.-Ky.	29.298	25.604	+ 3.694	+14.4	8.723	9.575	− .852	− 8.9	38.021	35.179	+ 2.842	+ 8.1
Okla.-Kans.-Mo.	15.478	12.955	+ 2.523	+19.5	2.355	2.339	+ .016	+ 0.7	17.833	15.294	+ 2.539	+16.6
Other Inland	8.110	6.090	+ 2.020	+33.2	2.067	1.369	+ .698	+51.0	10.177	7.459	+ 2.718	+36.4
Total Inland	57.307	48.198	+ 9.109	+18.9	14.404	14.505	− .101	− 0.7	71.711	62.703	+ 9.008	+14.4
Total East of Calif.	137.627	122.683	+14.944	+12.2	35.354	36.466	−1.112	− 3.0	172.981	159.149	+13.832	+ 8.7
California	12.979	13.476	− .497	− 3.7	.408	.309	+ .099	+32.0	13.387	13.785	− .398	− 2.9
Total U. S.	150.606	136.159	+14.447	+10.6	35.762	36.775	−1.013	− 2.8	186.368	172.934	+13.434	+ 7.8

Natural Gas and Refinery Gas Liquids





SUPPLY AND DEMAND STATISTICS

(Bureau of Mines Data)

CURRENT PRODUCTION (1000 b/d monthly average)	Aug. 1955	July 1955	Aug. 1954
At Natural Gasoline and Cycling Plants			
Liquefied Petroleum Gas	328	316	289
Natural Gasoline and Isopentane	288	283	272
Condensate	20	20	25
Finished Gasoline, Naphtha and other	63	60	56
Total Natural Gasoline and Cycling Plant Production	699	679	642
Liquefied Refinery Gases	119	123	88
Total Marketable Gas Liquids	818	802	730
Lease Condensate	104	103	94
Total Natural Gas Liquids	922	905	824

CURRENT DEMAND (1000 b/d monthly average)			
LPG and LRG	431	395	363
Natural Gasoline, Isopentane and other	384	349	377
Total Marketable Gas Liquids	815	744	740

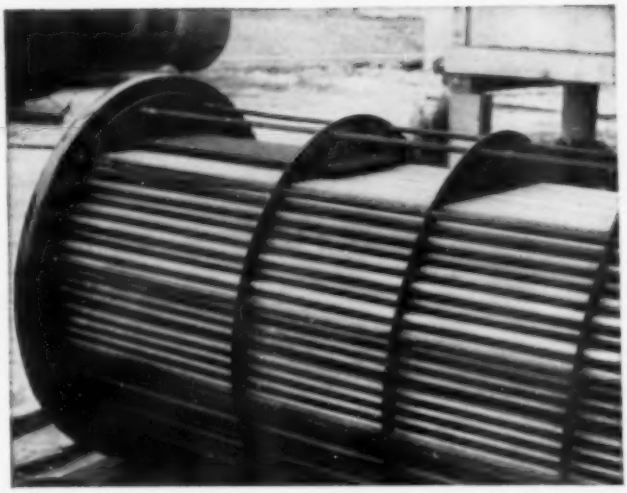
CUMULATIVE PRODUCTION (1000 bbls.)	Aug. 1955	Aug. 1954
LPG and LRG	111,462	118,957
Natural Gasoline, Isopentane and other	87,381	34,169
Total Marketable Gas Liquids	198,843	153,126

CUMULATIVE DEMAND (1000 bbls.)		
LPG and LRG	107,240	94,550
Natural Gasoline, Isopentane and other	87,779	85,435
Total Marketable Gas Liquids	195,019	179,985

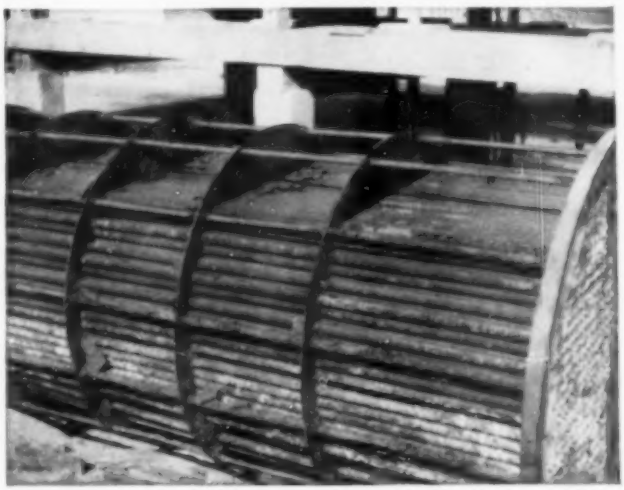
STOCKS (1000 bbls., end of month)	Aug. 1955	July 1955	Aug. 1954
LPG and LRG	11,980	11,478	9,581
Natural Gasoline, Isopentane and other	4,728	4,669	4,572
Total Stocks	16,708	16,147	14,153

Which bundle do you want to find

at turn-around time?



This?.. Here's what a refiner likes to see when he pulls his bundles at turn-around time. This clean, uncorroded appearance is typical of what can be expected when you use Polyrad.



or this?.. This is an all too common sight at turn-around time. Corroded and fouled bundles such as these call either for costly replacement, repair, or cleaning.

These two bundles from the overhead condensing system of a Gulf Coast refinery tell a story. One is what the refiner likes to find at turn-around time; the other, what he is likely to discover without Polyrad.

More and more refineries have found that when they use Polyrad, the filming amine inhibitor, they can expect to find bundles free of corrosion, ready for immediate return to service. As a result turn-around time no longer need be headache time.

Why not make use of Polyrad's detergency to maintain throughput, increase heat transfer, and cut down time for maintenance?

Stocks of Polyrad are maintained throughout the country. A Hercules technical representative will be glad to discuss its application to your operating conditions.

POLYRAD®

FILMING AMINE INHIBITOR

Pine Chemicals Division, Naval Stores Dept. **HERCULES POWDER COMPANY** *984 King Street, Wilmington 99, Delaware*

Dependable

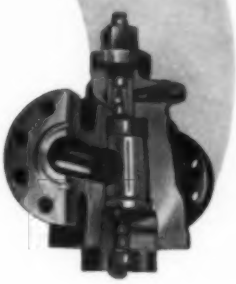
Rockwell-Nordstrom, *the* quality valve, is the most dependable valve you can use because it's *pressure lubricated.* Whether it is operated once a year or once every hour, the unique pressure lubrication system is always at work eliminating metal-to-metal friction, providing a leak-proof seal, and cushioning the plug for easy operation.

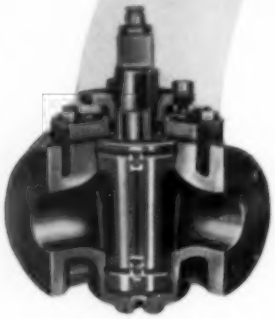
Rockwell-Nordstrom valves and plug valve lubricants are an investment you can always depend on for dividends in trouble-free service. Why not follow the leaders who have used Rockwell-Nordstrom valves for forty years? Rockwell Manufacturing Company, Pittsburgh 8, Pa.

ROCKWELL-Nordstrom VALVES

LUBRICANT SEALED FOR POSITIVE SHUT-OFF

GASES





Lubricant Sealing Holds Even the Lightest Gases

Rockwell-Nordstrom valves are the most efficient valves for any gas service because they're *lubricant sealed.* The unique Sealdport* grooves in the plug and body carry pressurized lubricant which forms a truly leak proof seal for the lightest hydrocarbons. Ordinary valves depend solely upon risky metal-to-metal closure where one tiny scratch means a leak.

Whatever your gas control problems, there is the perfect combination of Rockwell-Nordstrom valve and lubricant to do the job more dependably and economically than any other valve you've ever used. Write on your letterhead today for full details. Rockwell Manufacturing Company, Pittsburgh 8, Pa.

*a registered trademark of Rockwell Manufacturing Company

ROCKWELL-Nordstrom VALVES

LUBRICANT SEALED FOR POSITIVE SHUT-OFF

MARLEY IS TESTING COOLING TOWERS

AND HERE IS THE RECORD

TEST NO.	TYPE OF SERVICE AND LOCATION	SPECIFIED CONDITIONS				TEST RESULT	
		Gallons Per Minute	Hot Water Temp.	Cold Water Temp.	Wet Bulb Temp.	[1]Degrees Cold Water Temp.	[1]Percent Capacity
1	Air Conditioning—West Coast	400	90°	80°	70°	+0.80°	+9.4%
2	Air Conditioning—Gulf Coast	6,500	101.3°	88.5°	80°	—0.40°	—4.3%
3	Chemical Plant—East Coast	18,500	104°	89°	76°	+0.50°	+3.8%
4	Chemical Plant—East Coast (1 of 4 duplicate units)	27,500	103°	88°	76°	—0.40°	—3.2%
5	Power Plant—Southwest	57,500	109.6°	92.6°	78°	—0.04°	—0.4%
6	Petroleum Refinery—Gulf Coast	3,400	115°	80°	70°	+0.90°	+8.5%
7	Power Plant—South Central	83,000	108.1°	90°	76°	—0.04°	—0.4%
8	Power Plant—Mountain States	45,000	105°	83.7°	63°	+0.20°	+0.8%
9	Petroleum Refinery—Gulf Coast	15,000	111°	90°	82.5°	+0.70°	+7.7%
10	Petroleum Refinery—Gulf Coast	36,570	120°	90°	82°	—0.60°	—4.4%
11	Power Plant—Southwest	70,450	102.6°	86°	70°	—0.86°	—4.4%
12	Power Plant—Southwest	70,450	102.6°	86°	70°	—0.51°	—2.7%
13[2]	Power Plant—East Central	13,000	101°	85°	75°	—3.70°	—24.3%
14	Power Plant—Mid-Central	44,000	100°	86°	74°	+0.45°	+4.0%
15	Power Plant—South Central	83,000	108.1°	90°	76°	—0.80°	—4.3%
16	Chemical Plant—South	40,000	103.3°	85°	78°	—0.30	—3.0%
17	Power Plant—North Central	37,000	100.5°	83°	72°	+1.20°	+9.6%
18	Petroleum Refinery—East Coast	15,570	115°	85°	76°	+1.10°	+9.0%
19	Power Plant—Mountain States	65,000	101.7°	82°	63°	+0.78°	+4.1%
20	Chemical Plant—Gulf Coast	40,750	123°	90°	80°	—0.16°	—1.2%
21	Chemical Plant—Gulf Coast	11,000	116°	90°	80°	+1.80°	+13.2%
22[3]	Retest of Tower Reported in No. 14	44,000	100°	86°	74°	+0.45°	+4.0%
23[4]	Retest of Tower Reported in No. 11	70,450	102.6°	86°	70°	+0.20°	+1.1%
24[4]	Retest of Tower Reported in No. 12	70,450	102.6°	86°	70°	+0.33°	+1.8%
25	Petroleum Refinery—East Central	6,000	125°	90°	75°	—0.46°	—2.6%
26[5]	Petroleum Refinery—Gulf Coast	10,000	120°	85°	79°	+0.30°	+3.2%
27	Power Plant—Southwest	72,000	112°	92°	78°	+1.05°	+6.6%
28	AEC—East Central (1 of 2 duplicate units)	62,798	132.3°	90°	80°	+0.31°	+3.5%

NOTES: 1) Plus indicates capacity exceeding specified performance; minus denotes deficiency. 2) Tested to determine loss of performance due to extensive settling of basin and resultant misalignment of structure. 3) Retested at higher wet bulb. 4) Retested at contract (higher) horsepower. 5) Tested in accordance with Cooling Tower Institute test procedure (ATP-105 adopted May 1, 1955) and observed by CTI representative.

HERE IS THE RECORD — a consecutive list of ALL acceptance tests conducted by Marley during the 1954-1955 test seasons. All are full-scale tests conducted in strict accordance with specified methods.

Towers tested were of many sizes and capacities, operating under widely varying conditions. Geographically, these tests spanned the entire country and included towers sold since 1950, located at elevations up to 5,000 feet.

HERE IS THE RECORD that offers **more positive assurance of performance satisfaction than any guarantee ever written.** It shows why Marley has the complete confidence to insist that you TEST YOUR TOWER.

MARLEY

The Marley Company

Founder-Member Cooling Tower Institute

Kansas City, Missouri

ALUMINUM

...the heat exchanger tubing that COSTS LESS, resists corrosion, provides maximum heat transfer

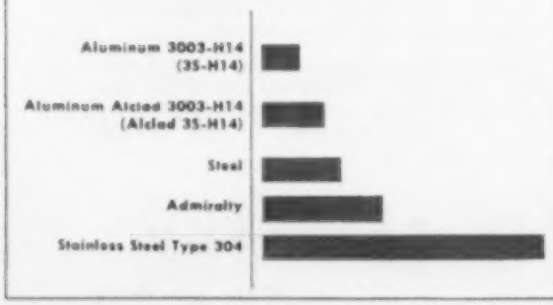
Two important advantages of aluminum make it the natural choice for heat exchanger tubing for most applications. The charts below illustrate cost savings and length of life that aluminum offers. In addition, aluminum heat exchanger tubing provides improved heat transfer rates due to its exceptional non-fouling characteristics.

To help you put these advantages to work in your heat exchanger operations, Reynolds engineers have prepared a sixteen page brochure titled "Reynolds Aluminum for Heat Exchangers." This booklet covers detailed engineering information necessary to the best use of aluminum in many types of heat transfer. The brochure, dealing with some of the varied application possibilities, is reproduced on the adjoining page. Copies of the brochure may be obtained by using the coupon in the lower right hand corner of this advertisement.

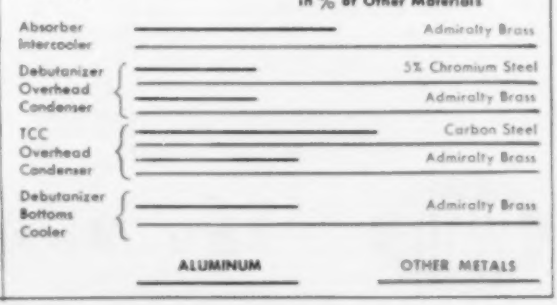
See Reynolds New Program "Frontier"—Sundays on NBC-TV.

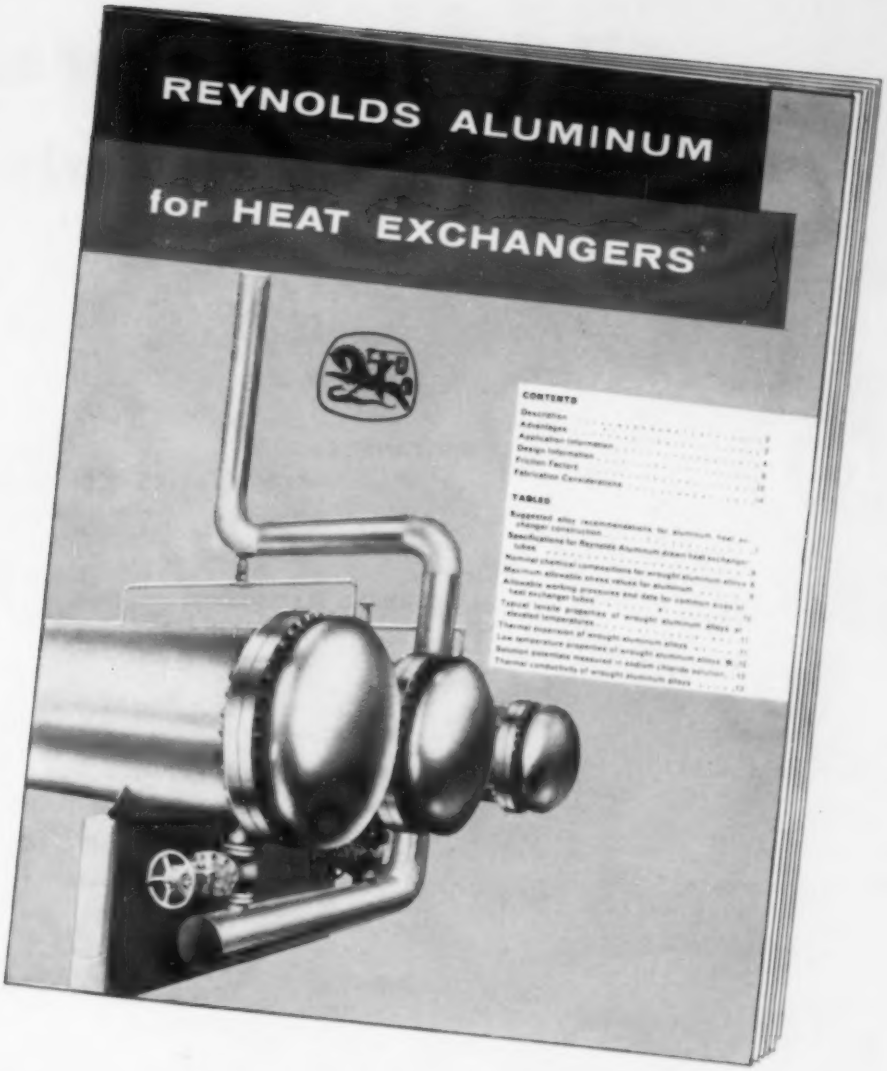
REYNOLDS

Comparable Unit Cost of Most Frequently Used Heat Exchanger Metals

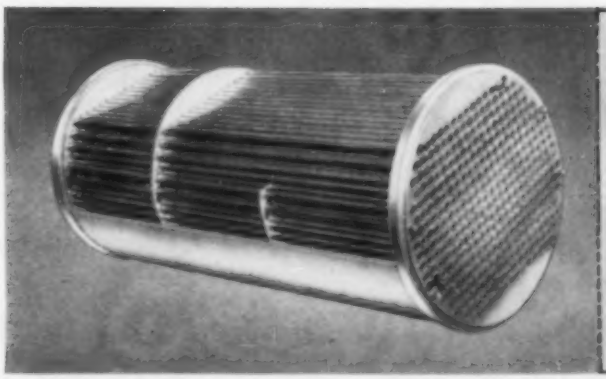


Comparison of Aluminum Service Cost in % of other materials





ALUMINUM



REYNOLDS METALS COMPANY
P.O. Box 1800—CS
Louisville 1, Kentucky

Please send me your 16-page brochure entitled "Reynolds Aluminum for Heat Exchangers"

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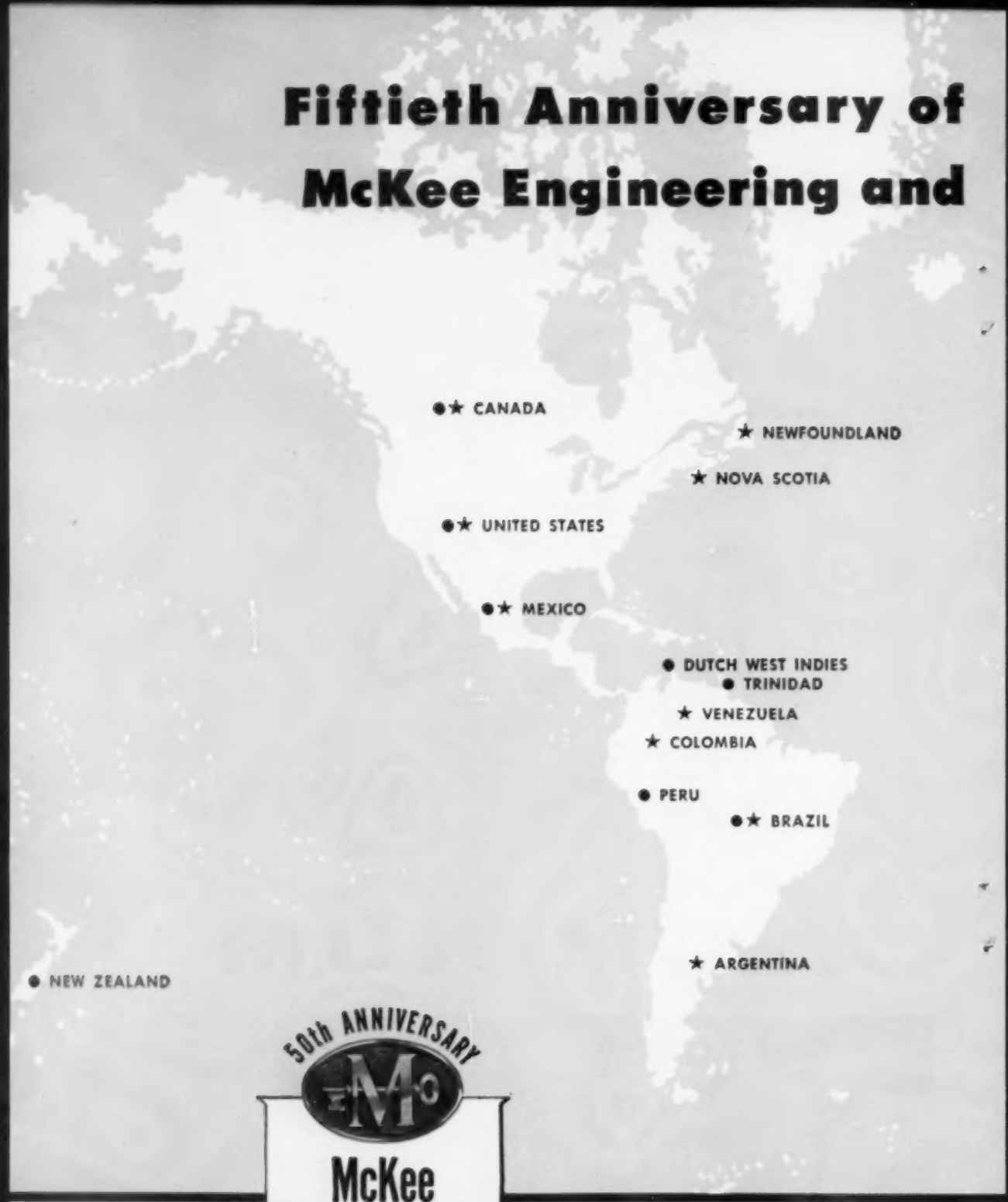
Company_____ Title_____

Street Address_____

City_____ Zone____ State_____

Fiftieth Anniversary of McKee Engineering and



50th ANNIVERSARY

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Arthur G. McKee &

HEADQUARTERS
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IN A HALF-CENTURY of engineering and construction Arthur G. McKee & Company have executed more than 2500 contracts for projects having a combined erected value of more than a billion dollars.

★ **IRON AND STEEL PROJECTS,** including completely integrated plants, blast furnaces, blast furnace components, steel-making plants and ore beneficiating units.

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Arthur G. McKee & Company of Canada, Ltd.
372 Bay Street
Toronto, Ont.

These are Zallea Pressure-Balanced Expansion Joints. They provide a sound engineering solution to the problem of absorbing pressure thrust where a change in direction occurs, and it is not possible to anchor the elbow.

Their operation is simple. Both expansion joints shown are designed to absorb axial and lateral movement in the inboard bellows. By means of tie rod action, the pressure thrust of the inboard bellows is balanced by the countermovement of the outboard bellows. This design is frequently used in piping connections to a turbine to eliminate the pressure thrust against the turbine casing. Many other applications may occur to the design engineer.

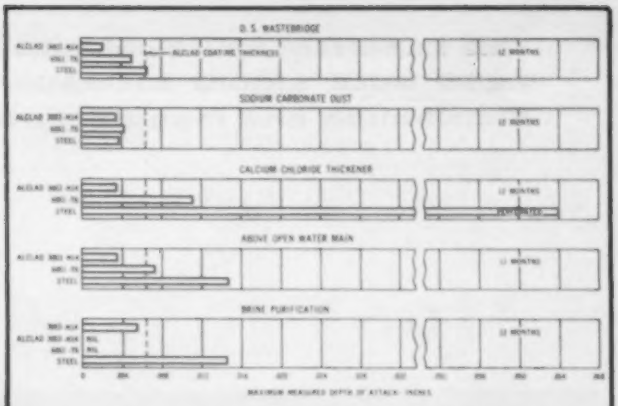
An original Zallea design, these specialized joints are another example of our ability to develop, engineer and manufacture expansion joints to meet your specific needs. For information on standard types, or help with special expansion or piping problems, call in a Zallea representative.

Zallea *expansion joints*

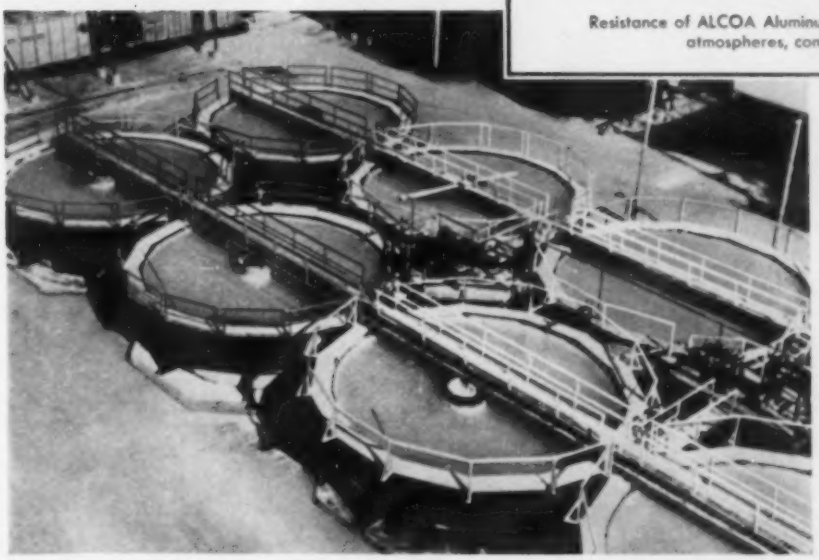
ZALLEA BROTHERS 822 LOCUST STREET, WILMINGTON 99, DELAWARE

World's Largest Manufacturers of Expansion Joints

Long service life, exhaustive tests prove Alcoa Aluminum resists soda ash plant atmospheres



Resistance of ALCOA Aluminum alloys to soda ash plant atmospheres, compared to steel



This ALCOA Aluminum alloy 6061 bridge over alkaline brine settling tanks in a soda ash plant is in good condition after eight years' service.

● Exhaustive cooperative tests and years of service are proving the value of ALCOA Aluminum in many soda ash plant installations. One such location is in and around alkaline brine settling tanks, where corrosion is severe. Other ALCOA Aluminum applications in soda ash plants include walkways, stairways, tread plates, handrails, doors, window frames, roofing and siding, heat exchanger tubes, vapor pipes and raschig rings. Field data have corroborated the general acceptability of ALCOA Aluminum in soda ash plants, and have resulted in many additional applications.

● High resistance to corrosion, as proven in applications such as the one above, is the most important property ALCOA Aluminum has to offer to the chemical and process industries. Longer life, reduced maintenance and less downtime result in substantial savings through the use of ALCOA Aluminum.

● Write today for detailed information on how ALCOA Aluminum can be used effectively in your operation. We will be glad to help you with *your* specific problem. Send today for the new 80-page ALCOA book, *Process Industries Applications of Alcoa Aluminum*. It contains the latest performance and design data on ALCOA Aluminum in hundreds of applications. Write on your company letterhead, or use the coupon.

ALCOA ALUMINUM
ALUMINUM COMPANY OF AMERICA

Aluminum Company of America
1000-M Alcoa Building
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Please send me your new FREE book, *Process Industries Applications of Alcoa Aluminum*.

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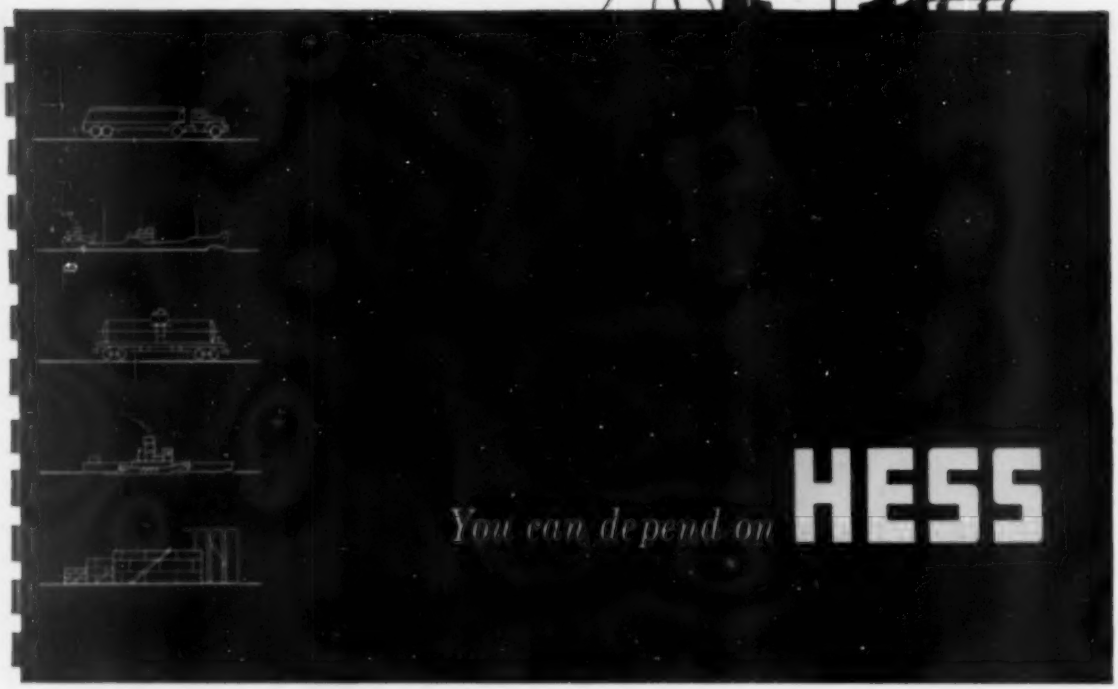
This important new book tells you how HESS BULK LIQUID STORAGE reduces distribution and manufacturing costs



The key to more than 400,000,000 gallons of bulk liquid storage capacity in the New York Harbor and on the Gulf Coast is yours *without capital investment.* The modern Hess storage terminals have individual tanks with capacities from 10,000 to 10,000,000 gallons. Absolute freedom from contamination is assured by separate pumps, valves, and pipelines.

Chemicals, petrochemicals, petroleum products, edibles and other bulk liquids can be *purchased at low seasonal or quantity prices;* shipped by tanker, barge, tank car or transport truck; stored economically in complete privacy; and converted by high speed drumming and canning equipment to meet the needs of your customers or your own process operations.

A policy that keeps our doors open around the clock and our operations under strictest laboratory control gives you all the advantages of your own storage plant *without capital investment.* For the full story of how bulk liquid storage at Hess terminals can reduce your distribution or manufacturing costs, *write for our new illustrated book "You can Depend on Hess."*

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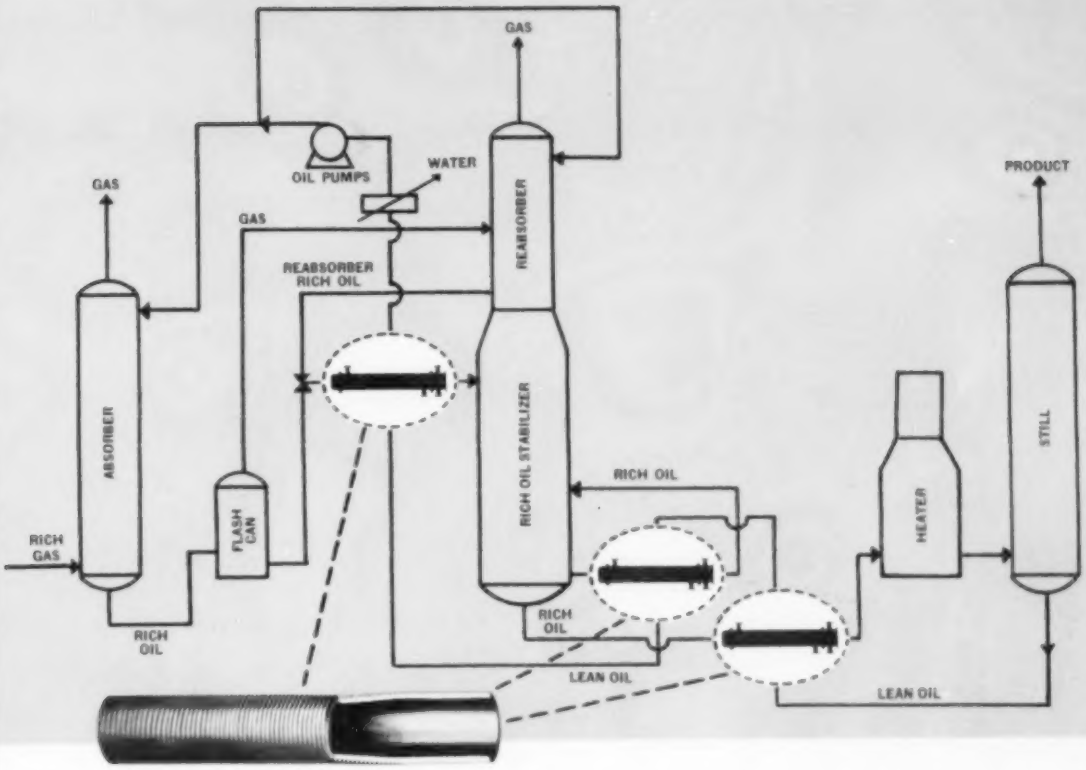
Real opportunities in heat exchange—
Number 12 of a series.

How One Southwest Processor Obtained Increased Efficiency in Lean Oil—Rich Oil Exchangers



HEAT EXCHANGERS TUBED *with Wolverine Trufin* Type S/T*

The light hydrocarbon recovery system charted above shows where Wolverine Trufin Type S/T condenser tubing was used effectively in lean oil—rich oil heat exchangers.

Trufin was specified by this processor when he found that it would help him transfer more BTU's per foot of tube—give him more capacity, using smaller units, than he could obtain with exchangers containing prime surface condenser tube.

Because Trufin is a finned condenser tube, there is more surface area available for heat transfer. Wolverine Trufin has *integral construction*—the fins are squeezed right from the tube wall—it has the stamina to stand up under rugged operating conditions.

Yes, you can cash in on these benefits, too. *Opportunity* is spelled out in a Wolverine technical book entitled just that. Write for your copy, today.

WOLVERINE TUBE, 1441 Central Avenue, Detroit 9, Michigan.

WOLVERINE TUBE

Division of Calumet & Hecla, Inc.

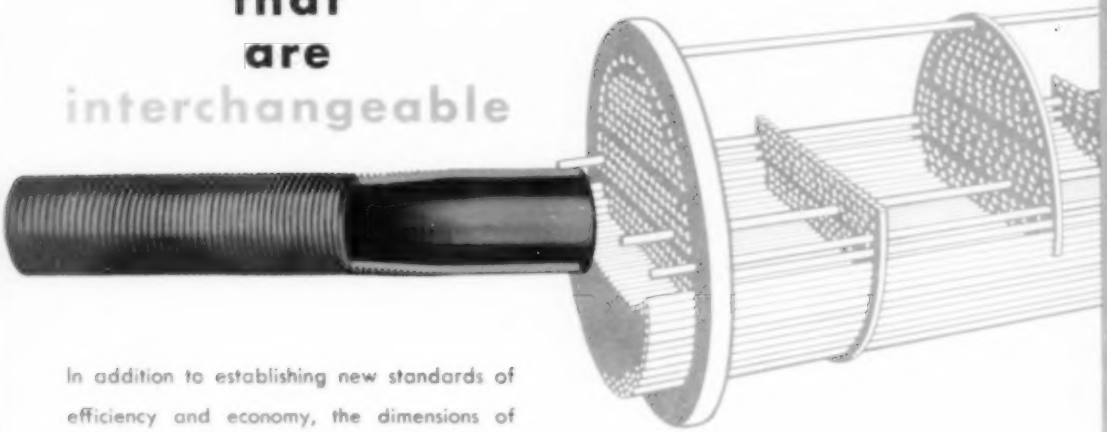
*REGISTERED U.S. PATENT OFFICE

PLANTS IN DETROIT, MICHIGAN, AND DECATUR, ALABAMA • SALES OFFICES IN PRINCIPAL CITIES

EXPORT DEPT., 11 E. 48TH ST., NEW YORK 17, N. Y.

CONDENSER TUBES

that are interchangeable



In addition to establishing new standards of efficiency and economy, the dimensions of Wolverine Trufin* Type S/T are such that it is completely interchangeable with prime surface tubing.

You can boost the capacity of existing units by *directly substituting* Trufin Type S/T for plain condenser tube. Type S/T is specifically designed for shell and tube heat exchangers. Being completely INTERCHANGEABLE—it can be rolled into tube sheets as easily as plain tube—using the same fabrication methods and the same tools.

Standard retubing procedures are used with Trufin Type S/T because the outside diameter of the finned section is no greater than the outside diameter of the plain end which is rolled into the tube sheet. As an additional design advantage, the wall at the plain end section is approximately two gauges heavier than the specified tube gauge. This affords a better bond at the tube sheet and provides additional protection against inlet erosion.

Because of Trufin Type S/T, you can now reap the benefits of extended surface condenser tube in existing equipment. Remember—Type S/T is INTERCHANGEABLE—specify it next time you retube. Write for the Trufin Opportunity Book. It will guide you to new heat transfer economy.

PRIME SURFACE TUBE

Remember, too, that Wolverine is a leading manufacturer of prime surface condenser tube. Wolverine customers can specify exactly the tube they need from a wide range of sizes and alloys in copper, aluminum and electric-welded steel.

*REG. U.S. PAT. OFF.

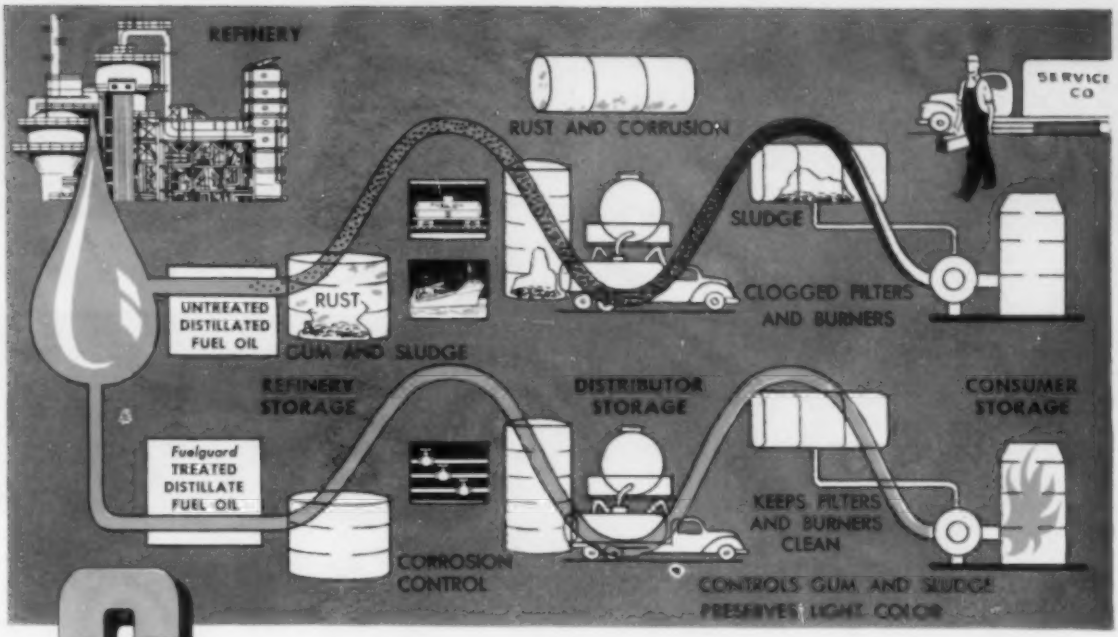
WOLVERINE TUBE

Division of Calumet & Hecla, Inc.

MANUFACTURERS OF QUALITY-CONTROLLED TUBULAR AND EXTRUDED ALUMINUM SHAPES

Wolverine Trufin is available in Canada through the Unifin Tube Company, London, Ontario

PLANTS IN DETROIT, MICHIGAN, AND DECATUR, ALABAMA. SALES OFFICES IN PRINCIPAL CITIES.



6 Fuel Oil Performance Tests

To determine fuel oil resistance to gumming and sludging, excessive darkening, water tolerance, and rusting, Carlisle Research in the development of Fuelguard adopted six test procedures. *You* will have a thorough evaluation of *your* fuel oils, too, by running the following—

1. OVEN AGE TEST
determines fuel oils that darken or haze excessively.

2. 24-HOUR OXIDATION STABILITY TEST
provides for rapid evaluation of the darkening and sludge forming tendencies of oils.

3. FILTER PLUGGING TEST
measures the effect of sludge build-up on filter flow.

4. BREAK POINT TEST
measures the length of time for heavy sludge to form in fuel oils.

5. CORROSION TEST
evaluates the corrosion and rusting caused by the presence of water in fuel oil tanks and pipelines.

6. EMULSION TEST
determines the degree to which water is emulsified in fuel oil.

Detailed Procedures Available

All six procedures with necessary equipment diagrams in printed booklet form and a Fuelguard brochure giving performance data will be forwarded upon request.

For your copy of the test procedures, write to . . .

Carlisle Chemical Works, Inc.

Reading, Ohio

Manufacturers of fine industrial chemicals

For wider adaptation . . . and unmatched Service Life . . . . .

Vogt GENERAL GP PURPOSE * DROP FORGED VALV

We invite you to inquire into the savings which the new line of Vogt GP Drop Forged Steel Valves can make possible in your operations. Not only do their many unique and exclusive features make them more economical of operation, but their broad adaptability to so many industrial applications permits a substantial reduction in operating overhead. Service life, too, is enhanced with Stellite faced seating surfaces which are available at no extra cost along with many other trims.

FREE
Supplement No. 1 to Vogt Catalog F-9

* GP Valves completely fill the demands of industry for a line of compact, lighter weight, shorter face-to-face valves.

Still retaining the safety and ruggedness inherent in a wrought material, these new forged steel screw and socket weld end valves, in sizes from ¼" through 2", are rated 800 pounds at 850°F. and 2,000 pounds at 100°F.

the New

STEEL

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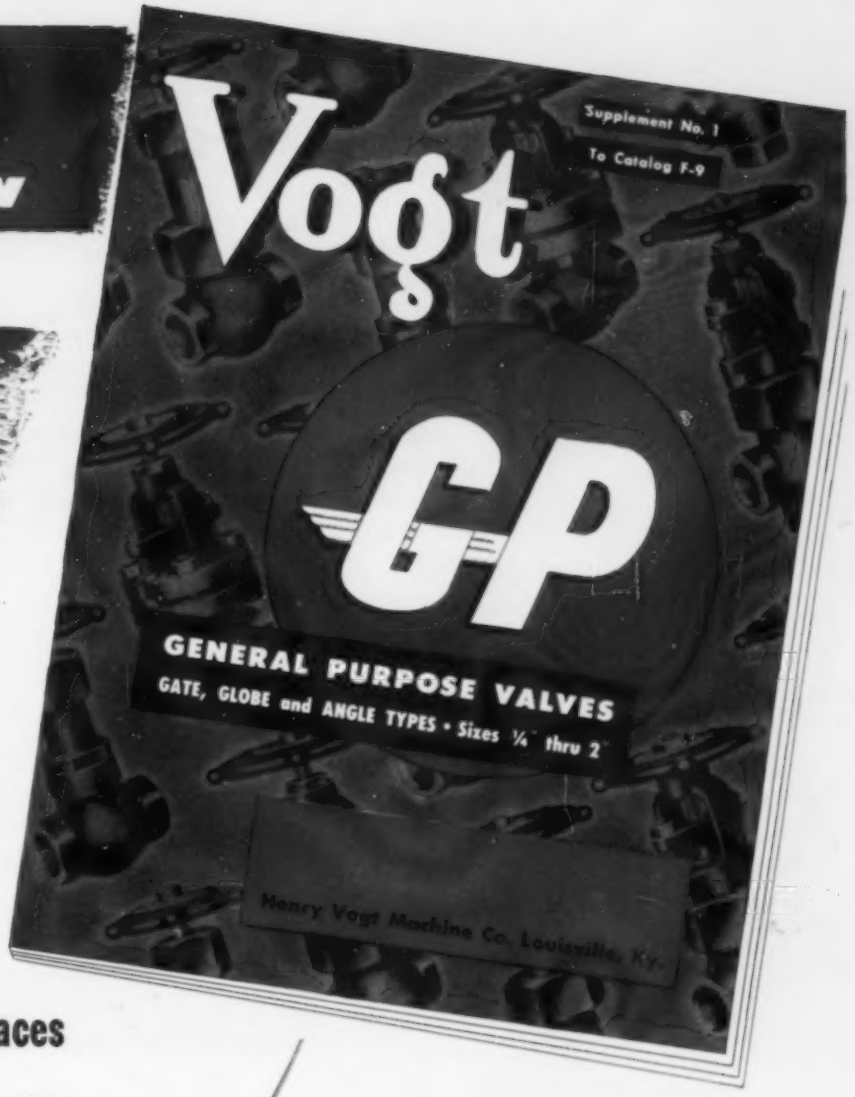

150-800 Pounds Service
(2000 pounds cold)

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Featuring Stellite Faced Seating Surfaces

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Sizes ¼" to 2"

This 32-page catalog illustrates and gives complete specifications on 11 types of the new Vogt GP forged steel gate, globe and angle valves. Send for your free copy—for ready reference in purchasing. Use the coupon for convenience.

HENRY VOGT MACHINE CO.
LOUISVILLE 10, KENTUCKY

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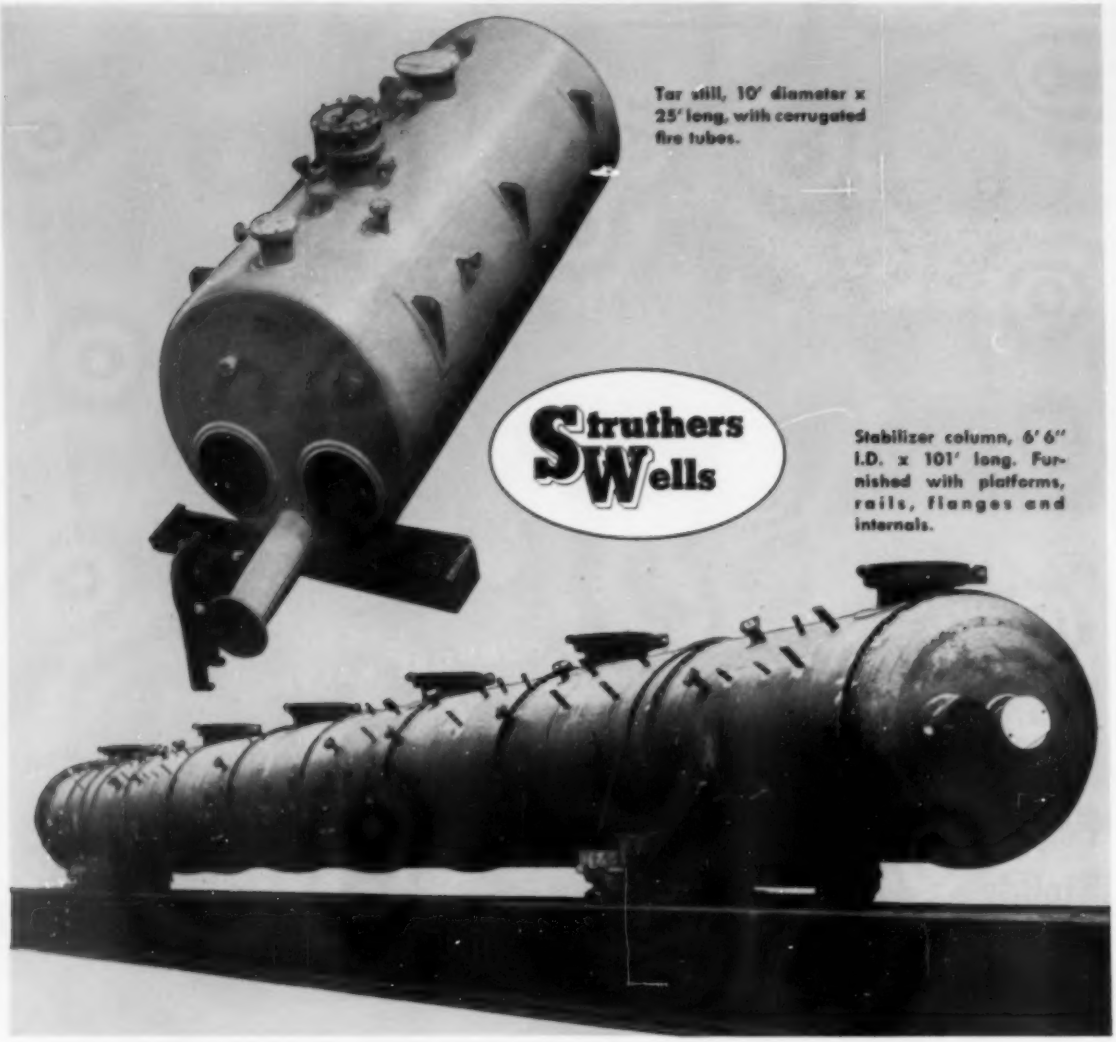
Tar still, 10' diameter x 25' long, with corrugated fire tubes.
Struthers Wells
Stabilizer column, 6' 6" I.D. x 101' long. Furnished with platforms, rails, flanges and internals.

EQUIPMENT IS RIGHT FOR YOUR PROCESSING JOB

. . . when Designed and Fabricated by Struthers Wells

When you choose Struthers Wells as your process equipment fabricator, you place your requirements in the hands of highly skilled engineers, technicians, craftsmen and capable business men—whose aim is to provide you with highest quality equipment at lowest possible cost. All work is performed in our own plants—from production of forgings, weldments, patterns, etc., to machining, latest X-ray inspection, stress relieving and water quenching. Thus, you have undivided responsibility of control in the fabrication of equipment—in any metal or alloy—to meet all ASME or API Codes and your most exacting specifications. Backed by over 100 years of experience in the chemical and petroleum industries—you know equipment is *right* for your processing job when built by Struthers Wells.

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Plants at Titusville and Warren, Pa.
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top Cat on cracking efficiency!

Aerocat Triple A*

high alumina catalyst

balanced with HI PV*

Both high pore volume and high alumina content—that's what AEROCAT TRIPLE A High Alumina Catalyst offers refiners. This combination boosts cracking efficiency through

higher initial activity
higher thermal and steam stability
lower stack losses
excellent selectivity

In AEROCAT TRIPLE A High Alumina Catalyst, Cyanamid has carefully balanced high pore volume with pore diameter and specific surface. The result is higher activity maintenance than is possible with low pore diameter high alumina catalysts.

AEROCAT TRIPLE A is the product of a 7-year research program at Cyanamid. Commercial experience in 24 units has yielded precise determinations of its cracking efficiency and product distribution in equilibrium. It's a proved and tested catalyst!

Your Cyanamid representative will be glad to tell you what AEROCAT TRIPLE A High Alumina Catalyst with HI PV can do for your operation. Call him today.

*Trade-mark

AMERICAN Cyanamid COMPANY
REFINERY CHEMICALS DEPARTMENT
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IF YOU'RE IN A HOLE OVER

THICKER AND BIGGER SHELLS . . .

KELLOGG'S EXPANDED FABRICATING FACILITIES CAN HELP YOU OUT

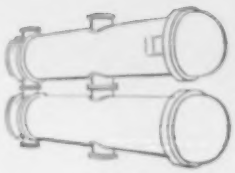
Why let shell geometry present a production bottleneck on urgently needed heat exchangers, towers, and other pressure vessels? M. W. Kellogg's expanded and complete fabricating facilities are geared to produce shells thicker, bigger, and in shorter time than ever before.

Production tools recently installed at Kellogg's New Jersey shop to meet increasing demands for larger vessels include: a planer capable of handling steel plate 40 feet long; huge bending rolls, augmented by a new, ancillary 2,000-ton press for bending plate up to 4 inches thick; and automatic welding equipment for longitudinal seams to 16 feet in length, and circular seams 12 feet in diameter.

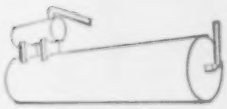
In heat treating, Kellogg now can handle vessels larger than a railroad car, with thirteen furnaces having temperature ranges from 1200 to 1950 deg. F. Its pipe bending facilities can shape carbon steel and alloy piping 36 inches in diameter—to exceptionally close tolerances. In nondestructive testing, Kellogg's latest addition is its Kel-Ray* Projector. Using gamma rays, this unique instrument permits the radiographic inspection of welded seams as thick as 6 inches in a single short exposure.

Backing up Kellogg's fabricating facilities are Kellogg engineers, who can either assume entire design responsibility or work closely with your own engineers; and Kellogg's staff of fabricating-welding engineers, who plan and administer a continuing personnel training program to qualify welders and mechanics on new techniques for fabricating new materials.

We welcome the opportunity to demonstrate what Kellogg's complete engineering and expanded fabricating service can do for *you*.



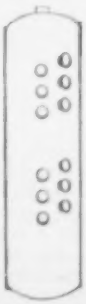
HEAT TRANSFER EQUIPMENT



TANKS AND REACTORS

KNOCKDOWN VESSELS

PROCESS PIPING



PRESSURE VESSELS

FABRICATED PRODUCTS DIVISION
THE M. W. KELLOGG COMPANY, 225 BROADWAY, NEW YORK 7, N. Y.
In Canada: The Canadian Kellogg Company, Limited, Toronto
In Europe: Kellogg International Corporation, London
SUBSIDIARIES OF PULLMAN INCORPORATED

*Trademark of The M. W. Kellogg Company

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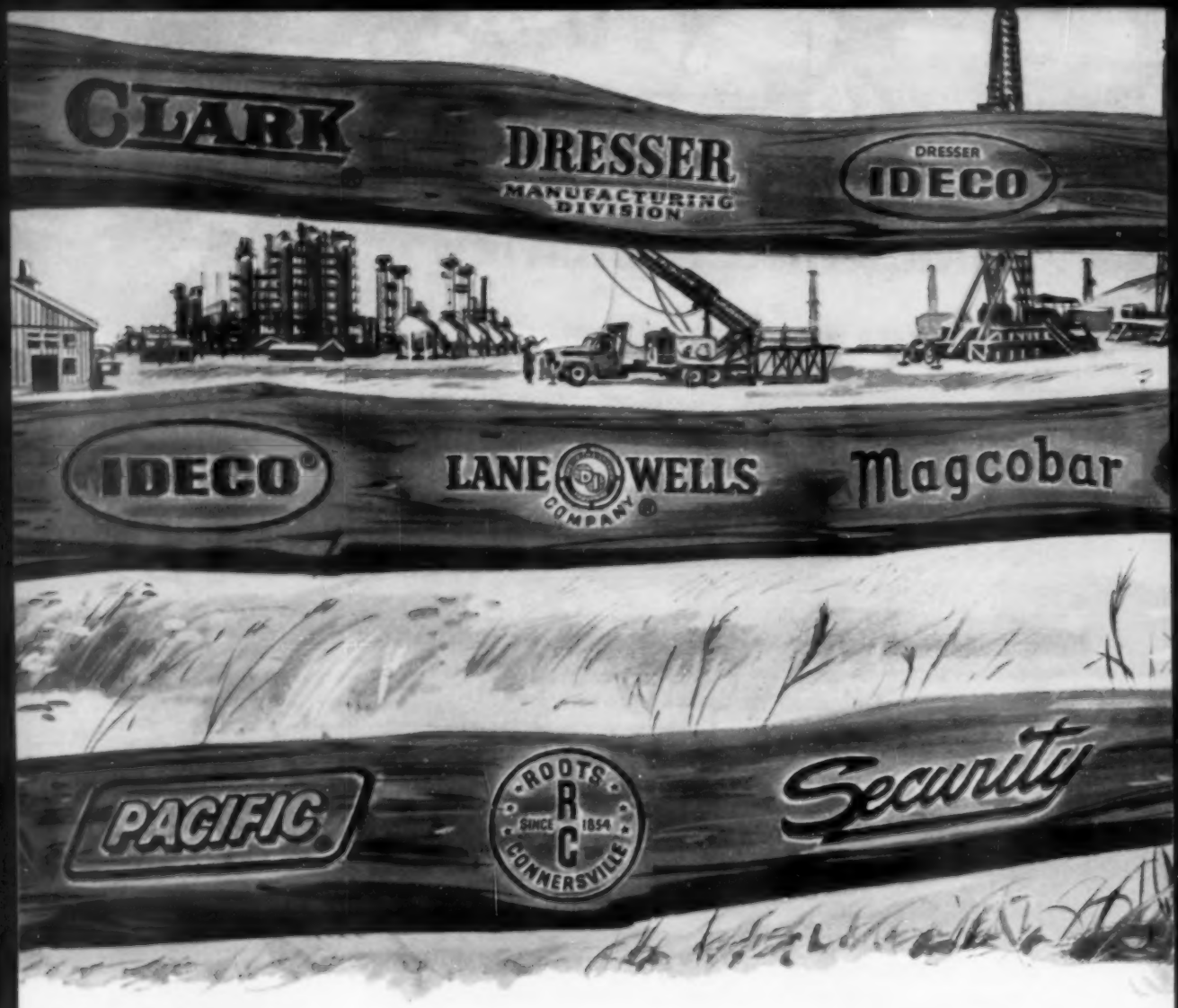

CLARK BROS. CO., Olean, New York — Gas turbines; engines, reciprocating, centrifugal, axial flow compressors—gas, steam, electric and diesel driven.

DRESSER MANUFACTURING DIVISION, Bradford, Pa.—Pipe line couplings, pipe repair sleeves and clamps, weldments and forgings, welding fittings, flanges, rings.

DRESSER-IDECO COMPANY Columbus, Ohio — Radio and television broadcasting towers, steel buildings, aircraft hangars, mechanical parking garages, electric power substations.

IDECO, Dallas, Tex. — Hydrair® and Power Rigs; Full-View® Masts; substructures; single, dual and Drive-In Rambler Rigs; blocks, swivels, rotaries; mud pumps; petroleum equipment and supplies.

LANE-WELLS CO., Los Angeles, California, Houston, Tex., Oklahoma City, Okla.—Electric and Radioactivity Well Logging, Koneshot® perforating and bullet perforating, packers and bridging plugs.

MAGNET COVE BARIUM CORP., Houston, Tex.—Magcobar® and Magcogel® drilling muds and other specialized oil well drilling fluids and chemicals.

PACIFIC PUMPS, INC., Huntington Park, Calif.—Centrifugal pumps for refineries, power stations, pipelines, and chemical plants; plunger pumps for oilwells.

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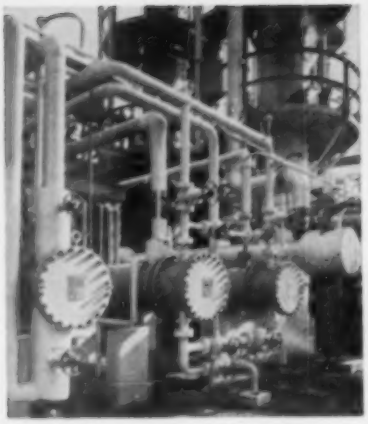


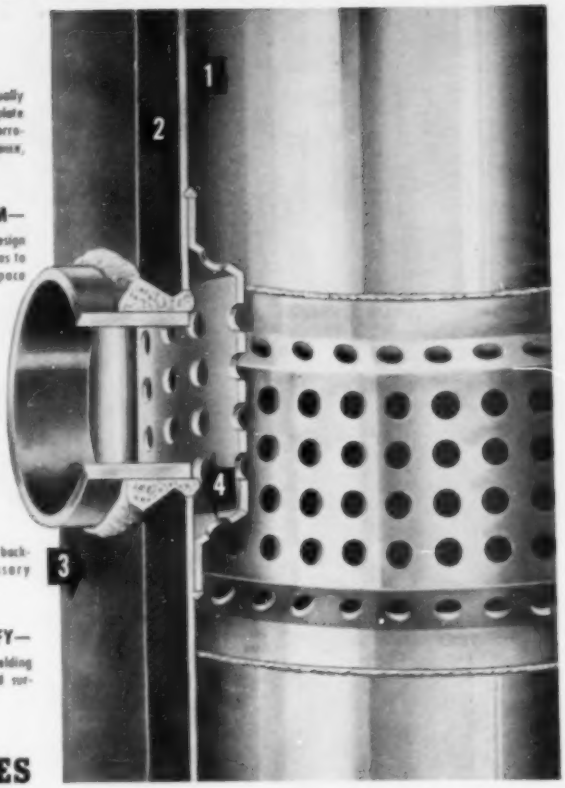
Stainless-clad steel checks corrosion in these acid stripping and cooling units handling naphthenic acid at 350° F.

1 ECONOMY—
High alloy layer—usually 10% or 20% of total plate thickness — assures corrosion and abrasion resistance, long equipment life.

2 DESIGN FREEDOM—
Integral bond allows design and fabrication of shapes to meet process and space needs.

3 STRUCTURAL STABILITY—
Low-cost carbon steel backing provides necessary strength and rigidity.

4 EASY TO MODIFY—
Normal cutting and welding will not endanger clad surface or bond.



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LONG LIFE AND EASY MODIFICATION

To help you lengthen profitable service life *and* overcome the factor of high first cost, clad steel equipment offers two unique advantages. First, clad steel construction permits easy tank and pressure vessel revision when new openings must be cut and flanges or pipes welded on. The bond between cladding and backing is not affected by the temperature range where clad can be applied. This eliminates seepage and crevice corrosion.

Second, you get all the benefits of solid high alloy's corrosion resistance and protection with savings up to 50% in material costs. Because cladding and backing are bonded over their entire surface, the API-ASME Code permits full gage consideration for design purposes.

Long service life and low cost protection, plus other advantages such as economical field erection and easier drainage, cleaning and inspection, can be obtained from 16 cladding materials. *Qualified* equipment builders know best how to apply these to your new processing equipment. By working with your own engineers and consultants from the start, they can help you get longer equipment life at lower cost. Lukens offers the widest available selection of clad steels—stainless, nickel, Inconel, Monel, copper—and cooperates with fabricators in helping you to select the type best suited to your needs. If you would like more information, consult one of your builders or write Manager, Marketing Service, Lukens Steel Co., 752 Lukens Building, Coatesville, Pa.

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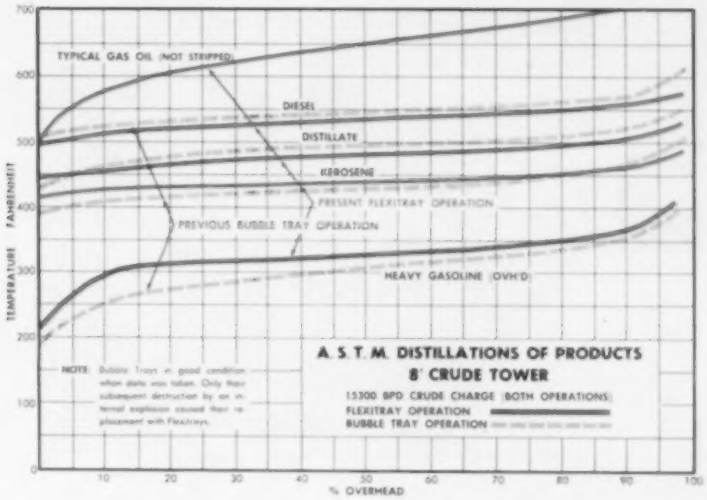
Why Top Performers Prefer

KOCH Flexitrays FOR CRUDE PETROLEUM DISTILLATION


TYPICAL GAS OIL (NOT STRIPPED)
DIESEL
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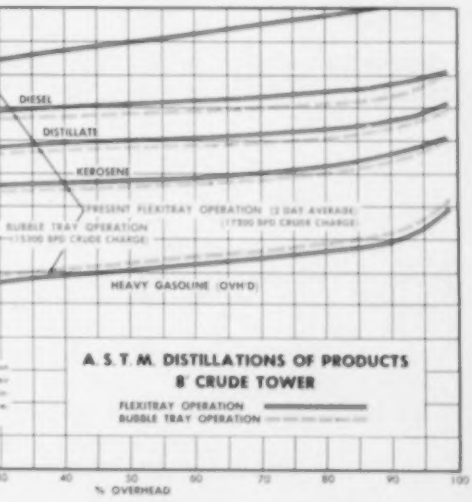
PRESENT FLEXITRAY OPERATION
PREVIOUS BUBBLE TRAY OPERATION
HEAVY GASOLINE (OVH'D)
TEMPERATURE FAHRENHEIT
% OVERHEAD
A. S. T. M. DISTILLATIONS OF PRODUCTS
8' CRUDE TOWER
15300 BPD CRUDE CHARGE (BOTH OPERATIONS)
FLEXITRAY OPERATION
BUBBLE TRAY OPERATION
NOTE: Bubble Trays in good condition when data was taken. Only their subsequent destruction by an internal explosion caused their replacement with Flexitrays.

The superior efficiency of the Flexitray at maximum bubble tray capacity is illustrated in the adjacent graph. The bubble tray ASTM's are indicating deterioration of quality and yield due to the presence of "End Point Tails." No such loss of efficiency is indicated by the Flexitray operating under identical process and thruput conditions. ←

The adjacent graph illustrates results with Flexitrays operating at some 11% above the "practical" capacity of bubble trays. Note that at this higher thruput the Flexitray is producing products of comparable quality to that of the bubble tray at a lower rate of thruput. The performance records of the Koch Flexitray are outstanding. Wire, write, or phone us on its application to your problem. →


TYPICAL GAS OIL (NOT STRIPPED)
DIESEL
DISTILLATE
KEROSENE
PRESENT FLEXITRAY OPERATION (2 DAY AVERAGE)
(17300 BPD CRUDE CHARGE)
PREVIOUS BUBBLE TRAY OPERATION
(15300 BPD CRUDE CHARGE)
HEAVY GASOLINE (OVH'D)
TEMPERATURE FAHRENHEIT
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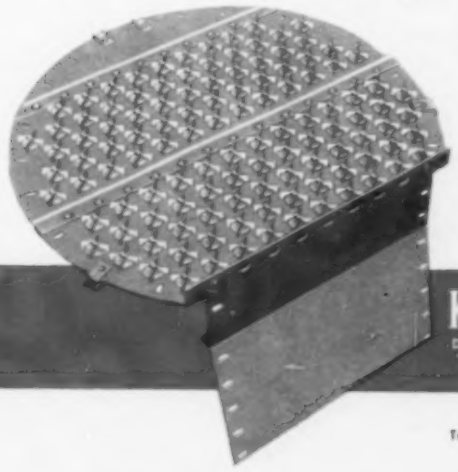

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MIDVALE FORGES STAINLESS STEEL

Official U.S. Navy Photograph

To Harness Atomic Power Underseas

In planning atomic-powered submarines, top-grade materials and top-quality workmanship were first considerations throughout.

Midvale is proud to have supplied the stainless steel forgings used in the heat exchanger system of the power reactor . . . proud because of the recognition thus given to Midvale quality . . . in steel making, in forging, and subsequent heat treatment, inspection and testing.

These forgings of type 347 stainless steel required the most careful control in the melting and casting of the ingots, together with the best in forging technique to produce material that would pass all of the exacting metallurgical requirements. The 100% Zyglo inspection, inside and out, was only part of the specifications. All forgings were fabricated by welding into the piping system and heat exchanger.

It will pay you, too, to call Midvale for any forging . . . carbon, alloy or stainless steel . . . any shape — rolls, gear rings, shafts, pressure vessels or a variety of other steel products.

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MIDVALE

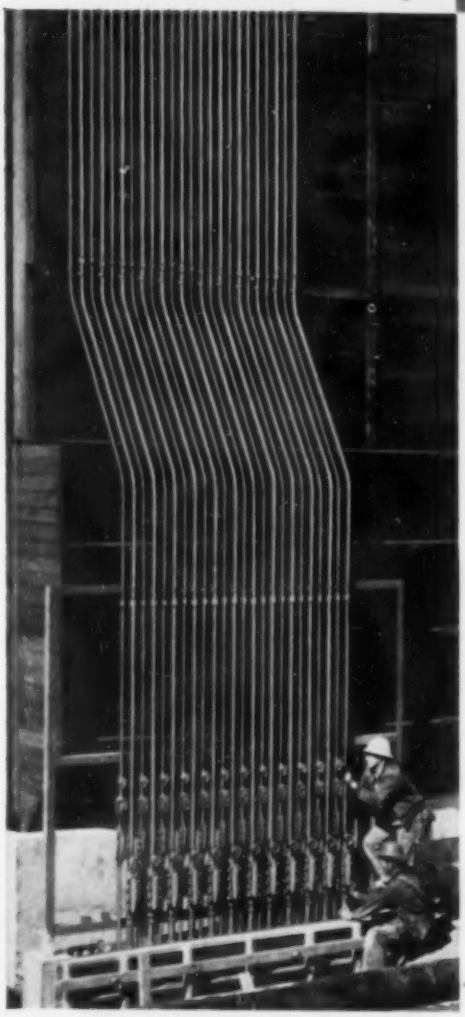
FORGINGS, ROLLS, RINGS, FLANGES, CORROSION AND HEAT RESISTING CASTINGS

(To obtain more data on advertised products see page 1964)

DOWN a humid 180 feet below water level at Downsville Dam

Some 3600 feet of 2" Everdur Conduit (E.M.T.) protect electric lines in a service shaft plunging down to the release water chamber 180 feet below water level at Downsville Dam of the New York Metropolitan Water Supply System. Electric lines operate vital valves, indicating and communication equipment.

UP in the corrosive air at a water cooling tower



During the War, General Petroleum Corp. saw galvanized conduit fail within a year at one of its plants—replaced it with Everdur Conduit. At its new Ferndale Mobilgas Refinery in Washington, some 12,000 pounds of Everdur Conduit in various sizes guard electric power lines for motors and lighting in this water cooling tower.

EVERDUR Conduit will guard the electric power lines—for years

Everdur* Never Rusts. It offers high resistance to other types of corrosion. That's why Everdur Conduit—made from one of Anaconda's exclusive copper-silicon alloys—is specified for dependable year-after-year protection of electric power lines in industry, on bridges, at power and water supply projects—wherever water and corrosive atmospheres are a problem—or where conduit must be buried or embedded in concrete.

Everdur is Tough. In addition to corrosion resistance, Everdur has high physical strength, resists wear and abrasion. It stands up under movement and vibration, as on a bridge, in a subway, in a factory.

Everdur is Nonmagnetic. Everdur Conduit creates no magnetic field to produce temperature rise in electric power cables.

Everdur Electrical Conduit is available in two wall thicknesses —R.C. in nominal sizes from ¼" to 4", inclusive, and E.M.T. in nominal sizes ⅜" to 2", inclusive. For more detailed information write: The American Brass Company, Buffalo Division, Buffalo 5, N. Y. In Canada: Anaconda American Brass Ltd., New Toronto, Ontario.

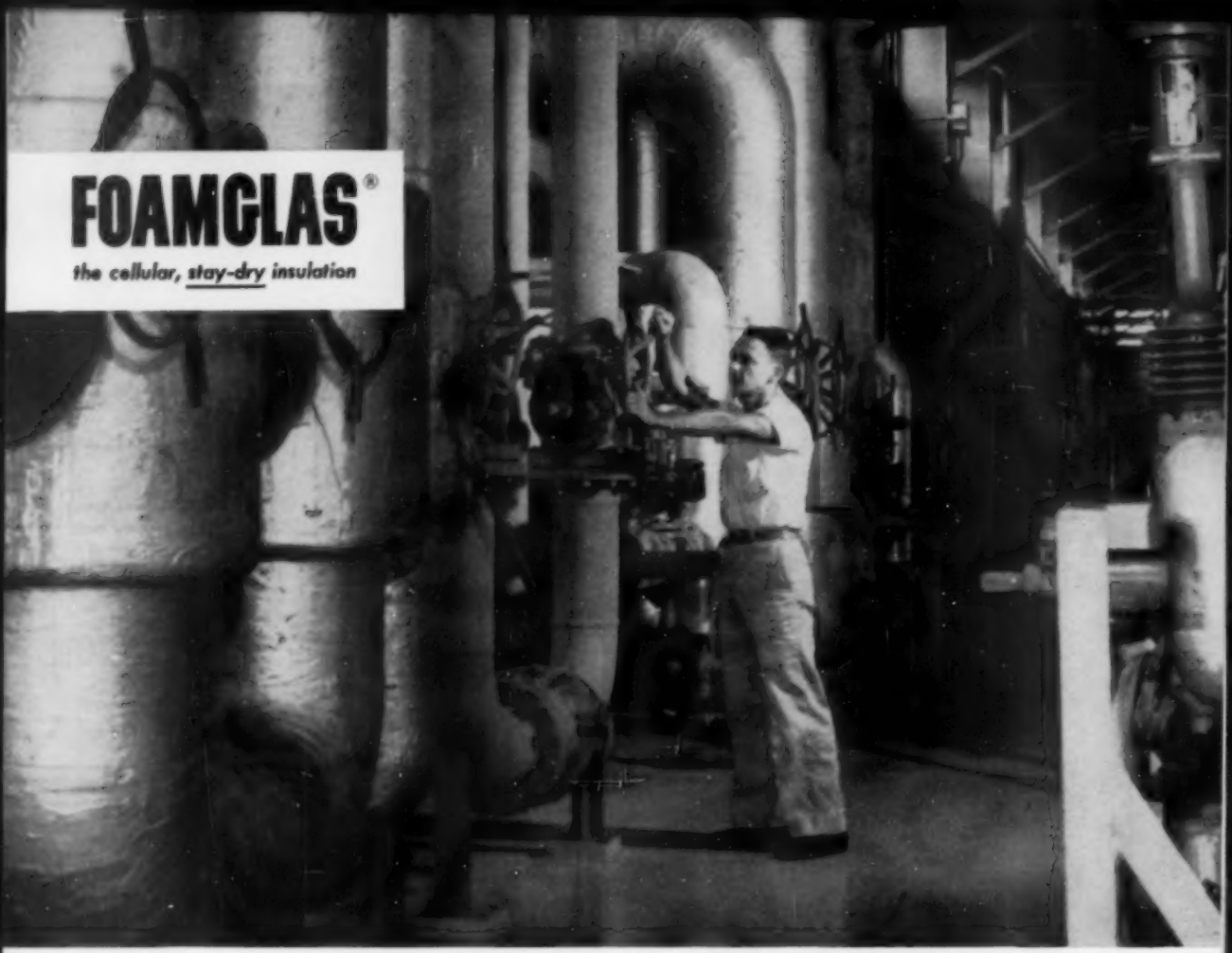
*Reg. U. S. Pat. Off.

EVERDUR ELECTRICAL CONDUIT

ANACONDA®

COPPER SILICON ALLOYS

CORROSION RESISTANT • STRONG • NONMAGNETIC • WORKABLE • WELDABLE



Lion Oil Co. maintains peak ammonia production because . . .

FOAMGLAS stays dry for constant insulating protection on refrigerated lines and vessels

Production of anhydrous ammonia at Lion Oil Company's Luling, Louisiana Plant requires extensive use of refrigerated lines and vessels. Precise control of temperatures (down to 12°F.) helps hold compressor suction pressure at 25 p.s.i. for peak production. Effective insulation is a must . . . but the area's prevailing high temperatures and humidities pose some tough insulating problems. FOAMGLAS solved them and gave Lion Oil these important benefits:

- The sealed glass cells of FOAMGLAS are unaffected by high humidity. That means *constant* insulating efficiency for dependable temperature control.
- Effective, *stay-dry* insulation prevents condensation on lines and vessels . . . thus cuts costly corrosion.
- Service to equipment is easily accomplished by cutting through the FOAMGLAS, then replacing only the insulation in the area immediately affected.

Recent inspection by Lion engineers showed FOAMGLAS was fully as effective as when originally applied in 1953. Maintenance has been negligible.

Whether you insulate piping, equipment or buildings, it will pay you to find out more about the *constant, long-lasting* insulating protection of FOAMGLAS. Send today for a sample and literature covering your specific needs.

Pittsburgh Corning Corporation

Dept. PP-125, One Gateway Center
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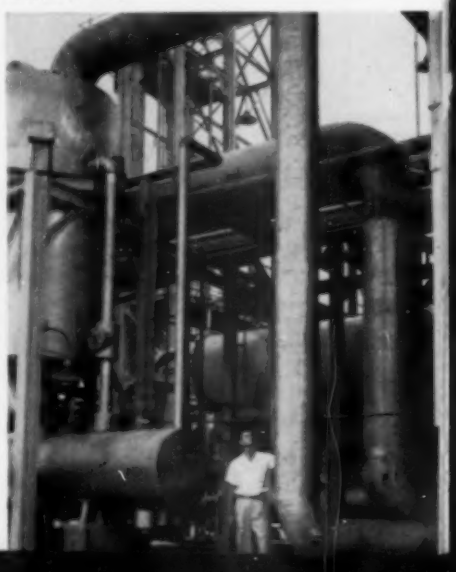
Visit our Booth No. 38 at the CHEMICAL SHOW, Philadelphia, December 5th to 9th

Light, rigid, easily shaped and fitted with available tools . . . FOAMGLAS can be swiftly and simply applied to piping and equipment of every size and shape. Insulation Contractor: B & B Engineering and Supply Company, Inc., Houston, Texas.



STANDARDIZE ON THIS FITTING AND YOU'LL REDUCE INVENTORY...SAVE MONEY...

it's the NEW 5000 TYPE ® KEY RETURN BEND FITTING

WITH HIGH DEGREE OF INTERCHANGEABILITY

TWO SERIES:
850 and 1275 LBS.
NINE FITTINGS
in each series

A TOTAL OF 18 FITTINGS, BUT REQUIRING ONLY 26 PARTS INSTEAD OF 72

HEADING UP OPERATION
Holding member and screw may be handled as a unit.

UNHEADING
A slight loosening of the screw permits holding member and screw to be removed as a unit. The stem has been designed to withstand plug removal by striking with a hammer.

SAFETY FEATURE
Plug can be loosened before a holding member is disengaged, preventing the possibility of the plug blowing out of fitting as the result of build up of back pressure.

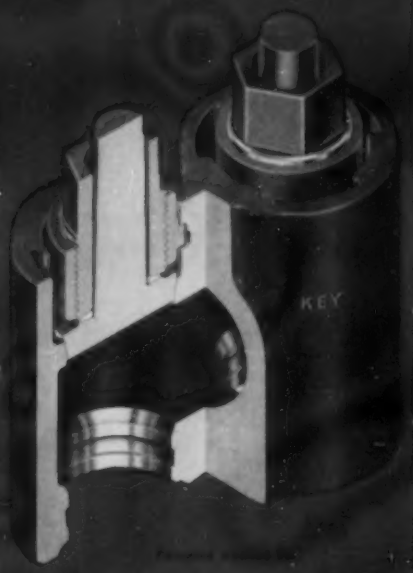
DAMAGED PARTS
If threads become damaged or frozen, holding mechanism can be removed by turning the breech.

STRESS DISTRIBUTION
Elliptical crossovers in the 5000-type give a maximum uniform distribution of stress. Plug hole section will be more uniformly stressed because of the added support of the 360° projection immediately above the plug seat.

METAL IN TENSION
The tension load is evenly distributed throughout the 360° circular projection.

SHEAR
The shear load is evenly distributed over 180°.

BENDING
No bending can occur in the holding member and the full 360° projection above the plug seat prevents bending of the lugs.



850 lb. and 1275 lb. series

Fitting Size	Plug Number	Holding Member Number	Gasket Number	Thrust Ring Number
2/1	8Y1	2Y1	9Y1	D-13011
			9Y2	D-13012
			9Y3	D-13013
6/6	8Y6	2Y6	9Y4	D-9356

All parts of the 5000-type fitting, exclusive of the body casting, are available for immediate shipment from stock.

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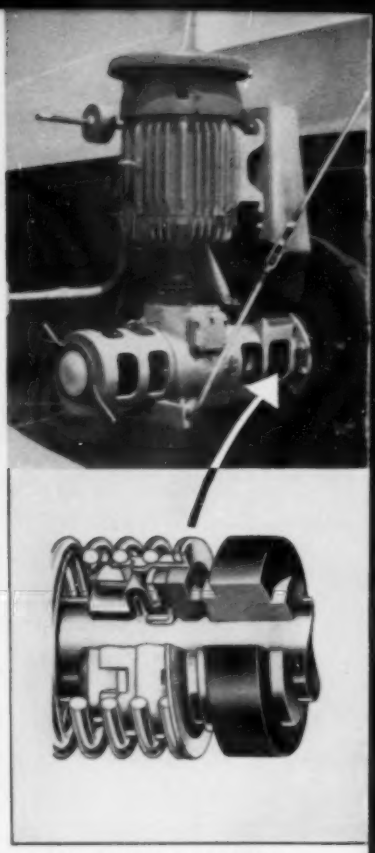
REMOVABLE SEAL CARTRIDGE is a complete unit assembly, easy to stock as a replacement, or quickly obtainable in all sizes and materials, for the simplest or most difficult operating conditions.



YOU CAN REPLACE A LIGHTNIN rotary seal in a few minutes—without special skill, without draining the tank or dismantling the mixer, without losing a pint of product. Seal is shown here without housing, to illustrate components.

Newest cost-saver in side entering mixers:

End stuffing box repacking . . . forever

with a rotary seal that's easy to replace

Now you can enjoy the solid maintenance savings of leakproof rotary sealing in a side entering mixer—without the headaches seal replacement *used* to cause.

For here, at last, is a rotary seal that runs *years* without adjustment—yet can be replaced *in a few minutes* when necessary, without draining the tank or dismantling the mixer, and *without need for special skills.*

Here's what you gain when you specify LIGHTNIN Mixers with new LIGHTNIN Seals:

1. You end leakage—for good. The seal positively will not leak during its operating life.
2. You *eliminate* the cost of repacking stuffing boxes. The LIGHTNIN Seal takes the place of a stuffing box. Under most conditions, it runs smoothly for *years* without changing.
3. You stop costly "nursing" of stuffing boxes. The seal *never* needs adjustment.
4. And most important (because it's never been possible before)—you can replace a LIGHTNIN Seal *in a few minutes*, should it ever become necessary. Only one simple *cartridge* component to remove and replace—and you're back in operation. So simple, anyone who can handle a wrench can do the replacement job *in minutes.*

Already, many oil companies are using LIGHTNIN Seals. Users report savings running into many thousands of dollars per year. Your LIGHTNIN Mixer representative can give you the full story—show you how much *you* can save. Call him today. Or get the facts by mail: Send the coupon for 8-page, fully illustrated bulletin.

Get the cost-cutting facts now... New 8-page Bulletin B-111 shows how you get maintenance-free sealing that really slashes fluid mixing cost to a new low. Send also for LIGHTNIN Mixer catalogs listed here. Free—no obligation. Just check data you want, tear out and mail to us today with your name and company address.

- ☐ B-111 LIGHTNIN Rotary Mechanical Seals
- ☐ DH-50 and DH-51 Laboratory Mixers
- ☐ B-102 Top Entering Mixers (turbine and paddle types)
- ☐ B-103 Top Entering Mixers (propeller types)
- ☐ B-104 Side Entering Mixers
- ☐ B-107 Mixing Data Sheet
- ☐ B-108 Portable Mixers (electric and air-driven)
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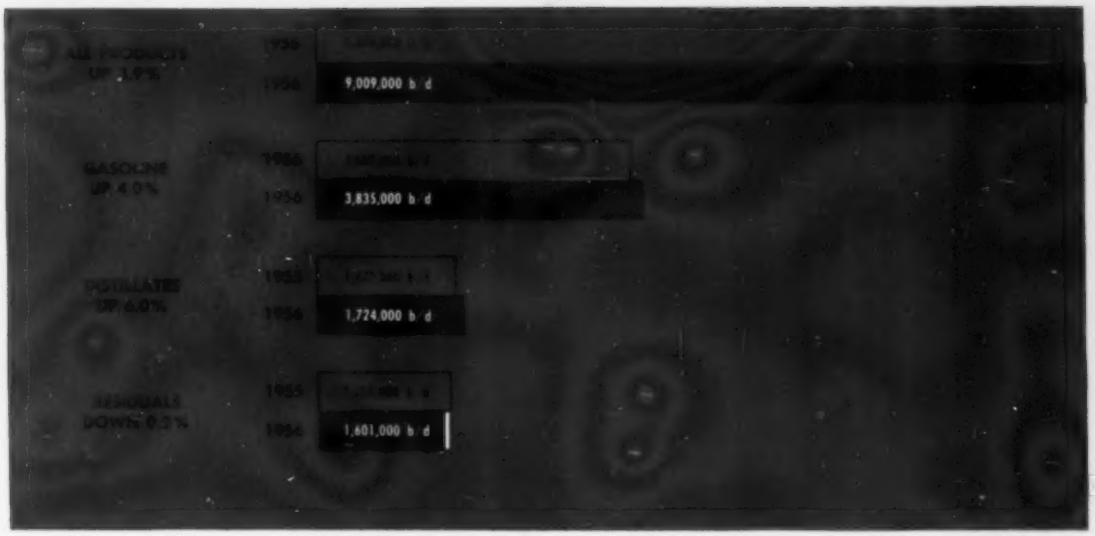
MIXCO fluid mixing specialists

Petroleum Processing

DECEMBER 1955



FORECAST FOR 1956

By V. B. GUTHRIE, Associate Editor

Demand over 9,000,000 b/d

TOTAL demand at U. S. refineries for all products in 1956 will reach a new high of 9,009,000 b/d average, according to PETROLEUM PROCESSING's annual sizeup of the coming year's petroleum needs. This is double the daily average demand of 1943.

Even oil men familiar with volumes running into millions of barrels, are impressed by what these 1956 requirements mean. A single day's shipments would fill 18,100 miles of 10-inch product pipeline. It would take 378 trains, each of 100 tank cars of 10,000-gal. capacity, to move one day's petroleum demand by rail.

The forecast shows 1956 daily demand is 3.9% greater than the present estimate for 1955, which is 8,674,000 b/d average. Total demand for the entire year, 3,296,500,000 bbls., is 4.1% larger than the total for 1955. The extra day in the 1956 leap year is responsible for 0.2% of this total. These forecasts for the coming year assume normal weather conditions will prevail.

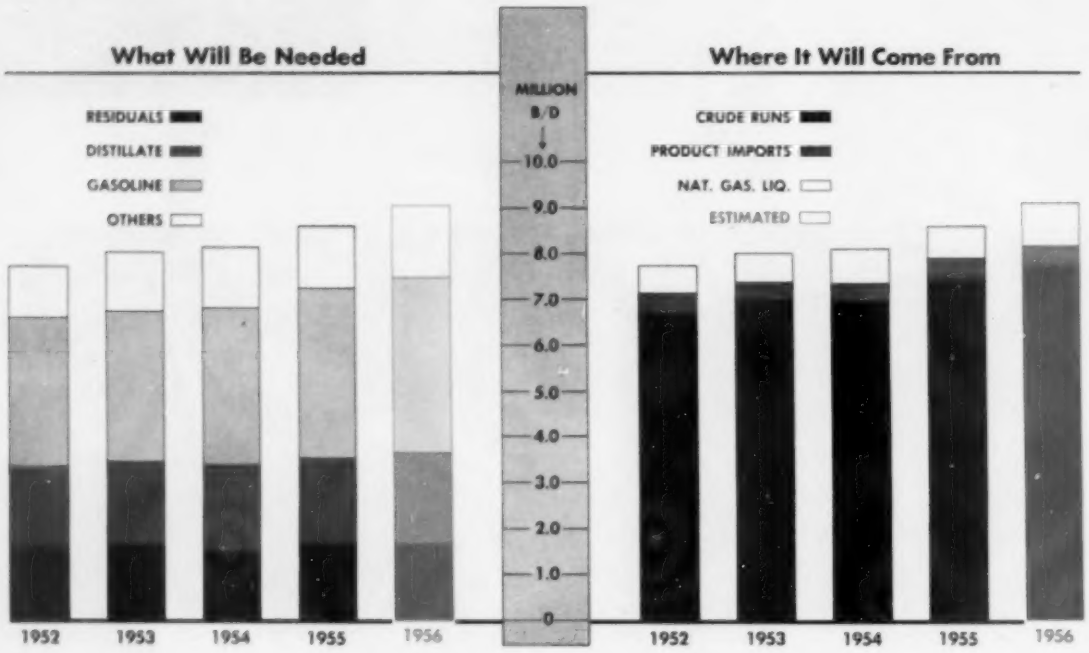
Daily domestic demand for all products in 1956 is forecast to be 4.4% greater than in 1955. It will be 8,683,000 b/d. Though our export trade will be 8.2% less than in 1955, it will require U.S. oil companies to supply 326,000 b/d in 1956. Detailed estimates for individual products are shown in the accompanying tables.

To supply these forecast volumes of products next year, refiners will process an average of 7,720,000 b/d of crude, and 890,000 b/d of natural gas liquids, not counting processing losses. It is estimated that about 400,000 b/d of imported refined products, mostly residual fuel oils, will be required to meet the 1956 demand.

These demand forecasts are compiled by the Editors of PETROLEUM PROCESSING from data individually submitted by the economists of the large oil companies and authorities in automotive, public utility, banking, military, and other fields.

Over 40 individuals were polled in the current survey. The figures presented are the averages of demand data from these various sources. They will give refiners targets of total demand, and help them

■ *Forecast for 1956*



Figures for Chart Above

(in million b/d)

What is Needed:

	1952	1953	1954	1955	1956
Residuals	1.593	1.607	1.504	1.605	1.601
Distillates	1.747	1.759	1.845	1.957	2.055
Gasoline	3.222	3.407	3.486	3.687	3.835
Others	1.150	1.232	1.273	1.425	1.518
Totals	7.712	8.005	8.108	8.674	9.009

Where It Will Come from:

	1952	1953	1954	1955	1956
Crude Runs	6.720	6.963	6.939	7.450	7.720
Product Imports	0.380	0.387	0.396	0.395	0.400
Nat'l Gas Liquids	0.612	0.655	0.773	0.829	0.889
Totals	7.712	8.005	8.108	8.674	9.009

sight their own markets for the coming year.

Important factors influencing refinery operations in 1956 in turning out their products in the volumes required include:

- A more rapid increase in the production of natural gas liquids than in U.S. crude oil production. This means more gas liquids will have to be processed in some fashion by refiners in 1956, and even in following years.
- Restrictions on imports of residual fuel oils, either by government decree or by voluntary action of the large oil companies, together with a static refinery output, will further tighten the available supplies of heavy fuel oil.
- The wide availability of catalytic reforming installations in the U.S. will bring more increases in the octane numbers of both premium and regular grade motor fuels.
- The growing demand for "other" products, including jet fuels, will require a sizable volume of crude for processing, in addition to that required for gasoline, kerosine, distillate fuels, and residuals.

1954-55 Influences On Next Year

Larger than anticipated growth in motor fuel consumption throughout 1955 is the main reason why total demand for all petroleum products this year will increase by 7% over 1954; an increase of only 4.1% had been forecast at the start of this year.

Gasoline shipments from refineries for the first four months of 1955 were 5.3% larger than the year before, while a gain of only slightly more than 4% had been forecast. It is now estimated that midsummer gasoline demand was over 6% greater, and for all 1955 the increase in gasoline demand will be 5.8%.

Gasoline supply at refineries has been greatly increased this year, because of higher crude runs and higher yields. However, gasoline stocks at refineries have run close to the 1954 level. Year-end gasoline stocks at refineries are estimated at 160,000,000 bbls., compared with 155,400,000 bbls. actual at the end of 1954.

The steady revival in industry activity generally throughout 1955 also increased demand for all products more than had been anticipated. Domestic shipments of distillate fuel oils will be 8.3% larger than in 1954, it is now estimated. With the high rate of refinery operations, stocks of distillate fuels reached higher levels than in 1954 and are expected to be 121,300,000 bbls. by Dec. 31, as compared with 108,100,000 bbls. Dec. 31, 1954. Domestic lubricating oil demand will be over 9.5% greater than in 1954; a gain of 1.8% had been forecast.

For 1955, an overall increase in residual fuel oil demand of 1.7% had been forecast. Actually, domestic shipments will be 6.1% larger and exports some 19% greater, reflecting the continued growth in 1955 of industrial activity in other countries. Total 1955 residual demand will be 6.7% larger than in 1954.

Petroleum Demand, 1954-1956

	1954	1955*	% Change	1956*	% Change	1955	1956
	DOMESTIC						
	(1000 b/d average)					(total 1000 bbls)	
Gasoline	3,393	3,597	+ 6.0	3,749	+ 4.2	1,313,000	1,372,000
Kerosine	323	319	— 1.2	321	+ 0.6	116,500	117,500
Distillate Fuel Oil	1,443	1,563	+ 8.3	1,664	+ 6.4	570,500	609,000
Residual Oils	1,430	1,517	+ 6.1	1,530	+ 0.9	553,500	560,000
Jet Fuels	126	160	+27.0	199	+24.4	58,500	73,000
Lubes	105	115	+ 9.5	121	+ 5.2	42,000	44,000
All Other	932	1,047	+12.3	1,099	+ 5.0	382,000	402,000
Total Domestic Demand	7,752	8,318	+ 7.3	8,683	+ 4.4	3,036,000	3,177,500
	EXPORTS						
Gasoline	93	90	— 3.2	86	— 4.4	33,000	31,500
Kerosine	14	11	—21.4	10	— 9.1	4,000	3,500
Distillate Fuel Oil	66	64	— 3.0	60	— 6.3	23,500	22,000
Residual Oils	74	88	+18.9	71	—19.3	32,000	26,000
Lubes	41	39	— 4.9	38	— 2.6	14,000	14,000
All Other	68	64	— 5.9	61	— 4.7	23,500	22,000
Total Exports	356	356	—	326	— 8.2	130,000	119,000
	TOTAL						
Gasoline	3,486	3,687	+ 5.8	3,835	+ 4.0	1,346,000	1,403,500
Kerosine	337	330	— 2.1	331	+ 0.3	120,500	121,000
Distillate Fuel Oil	1,508	1,627	+ 7.9	1,724	+ 6.0	594,000	631,000
Residual Oils	1,504	1,605	+ 6.7	1,601	— 0.2	585,500	586,000
Jet Fuels	126	160	+27.0	199	+24.4	58,500	73,000
Lubes	147	154	+ 4.8	159	+ 3.2	56,000	58,000
All Other	1,000	1,111	+11.1	1,160	+ 4.4	405,500	424,000
Total Demand	8,108	8,674	+ 7.0	9,009	+ 3.9	3,166,000	3,296,500

*1955—7 mos. actual, 5 mos. estimated.
1956 Petroleum Processing Forecast.
Note: 1956 has one extra day.

Refiners' Stocks—Principal Products

(In 1000 bbls)

	1954	1955				1956	
	Dec. 31*	Mar. 31*	June 30*	Sept. 30**	Dec. 31**	Mar. 31**	June 30**
Gasoline	155,400	184,000	157,400	151,300	160,000	184,900	160,300
Kerosine	27,800	18,200	29,900	36,400	28,000	17,500	28,500
Distillate Fuel Oil	108,100	62,500	100,700	143,700	121,300	65,200	97,600
Residual Oils	52,100	45,000	44,400	46,800	43,500	39,100	42,000

*Actual.
**Forecast as adequate for market requirements.

First Half of 1956 Will Be Higher

Demand for petroleum products in 1956, following the pattern of the national economy, will continue to expand significantly until the middle of the year. Authorities surveyed by PETROLEUM PROCESSING believe it is then possible that three factors—a slackening in the rate of inventory building, in home building, and a tightening in instalment credit—may result in lower industrial production in the second half of the year, and slow down the gain in petroleum demand.

On the other hand, if the President's illness or other factors should result in a Democratic victory at the polls in November, the current boom might take off again in the form of more price inflation than we have had since the Republicans came into office in 1952.

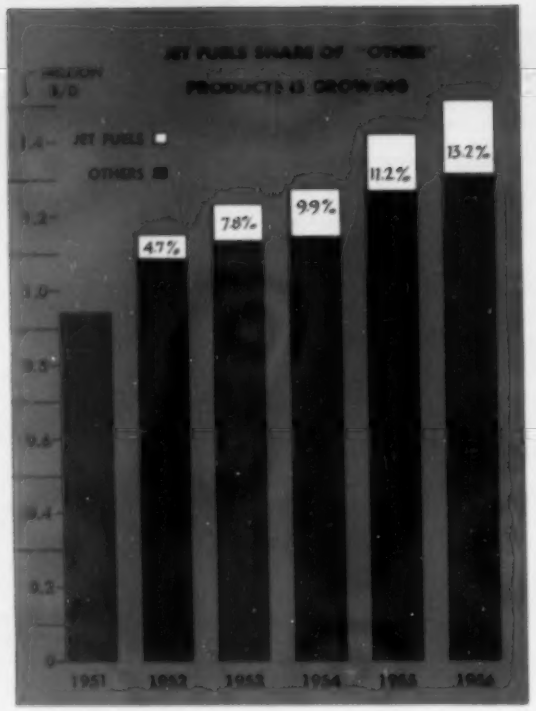
Key to next year's growth in demand will be the growth in gasoline consumption because it is the refiner's largest volume product. Normal snowfall during the early months will encourage winter driving. Domestic gasoline shipments from refineries may reach an average close to 3,750,000 b/d for the year, a 4.2% increase from 1955. An additional and larger drop than a year ago in gasoline exports is anticipated, leaving the overall gasoline demand for 1956 at 3,835,000 b/d average, 4% larger than in 1955.

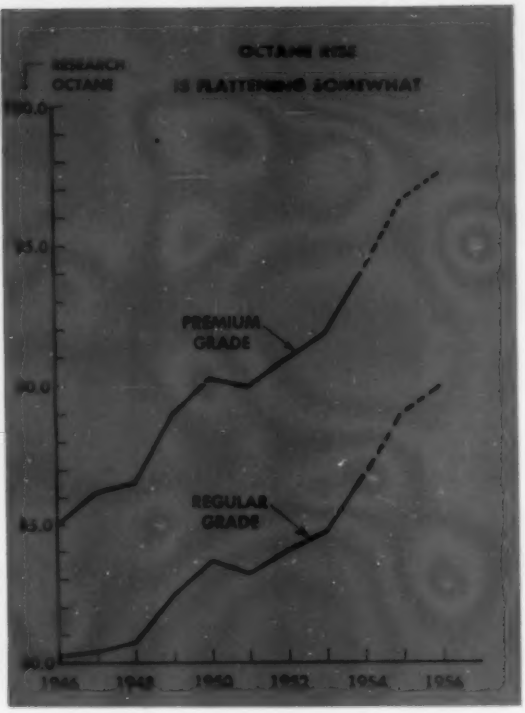
Credit restrictions on new home-building will probably mean fewer domestic residences completed and sold in 1956, and fewer oil burners installed than the estimated 500,000 going into new homes for the current winter. However, continued expansion in heating oil shipments is expected, with domestic demand 6.4% greater than in 1955. Allowing for another drop in exports, an overall gain in demand of 6.0% from 1955 is forecast.

Only a small increase (0.9%) is forecast for domestic residual fuel oil demand, compared to the increase in 1955 of 6% over 1954. Export trade has been high this year, mainly because of shipments to South America and Japan. This is expected to drop in 1956, leaving overall demand about the same as for the current year, 1,601,000 b/d average.

Refining Capacity Still Growing

Expansion of basic refining capacity in the U.S. will continue in 1956 at a





rate commensurate with the growth in product demand. The Office of Defense Mobilization has increased the basic refining capacity goal from 8,750,000 bbls. to 9,000,000 bbls., to be reached Jan. 1, 1957. During 1955 and 1956, nearly 400,000 bbls. in new capacity will be installed, which will bring the total for the country close to the projected 9,000,000 bbls. In 1955, refineries have been operating at close to 90% of installed capacity. It is likely that 1956 operations will be at about this same rate.

The volume of natural gas liquids available to refiners in 1956 will be further increased if imports of crude are materially reduced, whether by government regulation or voluntary action by the oil companies. The resulting increases in the volume of domestic production will add proportionally to the volume of gas liquids extracted from the gas produced along with the crude oil.

The output of gas liquids has been increasing at a greater rate than that of crude petroleum in the U.S. for some years, thus emphasizing to refiners the importance of making the most economic use of this important hydrocarbon resource.

From 1950 through 1954, while crude production increased about 17%, the output of gas liquids, including refinery off-gases, gained nearly 55%. Current production of gas liquids is over 830,000 b/d average, not including lease condensate shipped with crude oil in pipelines, which is over 100,000 b/d. Their use by refiners has been growing at a much lower rate than their production. Other uses for the gas liquids, such as fuels and conversion into chemicals, have taken up most of the increase in supply.

The domestic market for residual fuel oils will be more a matter of adequacy of supply than of expansion of demand. In fact, demand which is now forecast at only 0.9% larger than in 1955, would probably be greater if the supplies proved sufficient for all needs. Under the tight market conditions now anticipated, a few oil companies may even find some fringe accounts shifting over to coal during the coming year.

Limitations on the imports of residual fuel oil will hold in 1956, again, whether they are achieved by government decree or through the voluntary action of individual oil companies. Through the oil companies' efforts, the volume of these imports has been dropping since last spring, when the President's Cabinet Fuels Policy Commission recommended that imports of both crude and residual fuels be held in each instance to their ratio to U.S. crude production during 1954. That ratio for residual fuels was 6%. In volume, imports of residuals averaged 353,000 b/d. For this year, through the middle of October, imports have averaged about 375,000 b/d, and it is expected the average will be lower by the end of 1955.

Some authorities believe that restricting the rate of imports in 1956 to under 400,000 b/d average would result in economic hardship to some types of users, who might in some instances be faced with converting their burners to use coal. The fact that East Coast and Gulf Coast refiners in 1954 produced residual fuel at the combined rate of only 475,000 b/d shows the extent to which the large eastern industrial fuel oil consuming territory is dependent on imports of this product.

A lower rate of imports is not the only factor indicating a tight residual fuel oil market in 1956. Nationwide refinery output of this product is static and even trending slightly downward as refiners convert a larger proportion of the crude they process into more profitable products. Also, refinery stocks at mid-October totalled 47,300,000 bbls. for the U.S., more than 9,000,000 bbls. less than on the same date in 1954. They cannot be considered burdensome for a product for which demand in the first six months of 1955 averaged around 1,675,000 b/d.

Slackening in Octanes

The chief quality improvement in 1956 in motor gasolines will be continued advances in the octane numbers of both premium grade and regular

fuels. However, the rate of advance will be less than in recent years. Since 1952, when catalytic reforming became widely available to refiners as a means for improving the anti-knock quality of their motor gasolines, octane numbers have advanced by 2 or more each year.

Oil company and automotive authorities reported to PETROLEUM PROCESSING that, by the end of 1955, the nationwide average octane number for premium fuel will be 96.5, and for regular, 89. By the end of 1956 they will be 97.5 and 90 respectively. Some gasolines of higher than these average octane values will be marketed during the coming year, but it is considered doubtful that many companies will be selling 100-octane gasoline even by 1957.

Automotive engineers feel that the combination of built-in mechanical octanes in their newer models and the competitive octane race among the oil companies will continue to provide adequate fuel qualities, even though compression ratios in the 1956 models are advanced by about half a point.

"Other" Products a Key, Too

An important consideration in 1956 planning by refiners will be the requirements for crude for products other than gasoline, kerosine, distillates, and residual fuel oils. The combined volume of these "other" products in the coming year will be about 1,518,000 b/d average, close to the individual volumes of the distillate fuel and residual fuel oils.

This group of products has grown in demand by over 60% from 1951, while that for the four mass volume products together has increased by only around 18%.

Largest growth in consumption for any individual product in the group is in jet fuels, which were not classified as a separate product in 1951 but which, it is estimated, will reach close to 200,000 b/d average in 1956. Of this total, military requirements will take about 175,000 b/d.

Demand for lubricating oils, another of this group of products, has declined from 164,000 b/d average in 1951 to a forecast 159,000 b/d in 1956. Among the smaller volume products in this classification, coke and asphalt have grown materially in demand.

The list of products other than the four mass volume items which require a growing proportion of the refiners' crude supply includes jet fuels, lubricants, wax, coke, asphalt, road oil, liquefied gases, and miscellaneous. As reported by the Bureau of Mines, the group also includes still gases and losses.

Here Are Some of the Economists Who Make this Annual Survey Possible

J. D. Colclough, petroleum economist, Federal Reserve Bank of Dallas, since 1949. Economist, United States Treasury Department, 1941-45, and Commander, U.S. Public Health Service, 1945-49

N. G. Dumbros, economics and statistics department, The Ohio Oil Co. With Ohio Oil 10 years. With Petroleum Administration for War, 1941-45, engaged in economics work

J. W. Ferguson, acting manager, coordinating and planning department, Continental Oil Co., joined Conoco in 1952. Before, he was with the Bureau of Mines and with gas companies in Texas and Colorado

E. T. Knight, associate economist, Atlantic Refining Co. With Atlantic since 1920. He is a member of the American Petroleum Institute and of its Statistical Advisory Committee

W. L. Leavitt, director commercial research division, Standard Oil Co. (Indiana). With Standard since 1946. In economics work in banks and universities since 1936

A. J. McIntosh, chief economist, Socony Mobil Oil Co. With Socony 33 years, most of that time in the statistics-economics department. Frequent writer and speaker on economics

E. F. Perkins, petroleum economist, executive department, Gulf Oil Corp. With Gulf since 1924, economics work since 1936, and in engineering and plant supervision from 1920

J. G. Winger, petroleum economist, Chase Manhattan Bank, since 1950. With Cities Service Oil Co., 1946-50, as petroleum economist. Editor of a monthly petroleum industry survey

New Petrochemical Terminal Aims . . .

. . . PURITY

PURITY—Clearly marked transfer lines for moving petrochemicals from tanker to terminal storage tanks

. . . SAFETY

SAFETY—Permanent foam system valve manifold to direct fire extinguishing material to the affected tank or area

. . . SERVICE

SERVICE—Rapid communication by teletype from Newark, nerve center of Celanese petrochemical distribution

WHAT is the best way to deliver up to 50 different petrochemical products—both liquid and solid—to many different customers and still maintain high standards of purity, service, and safety?

It will probably pay you to look at what Celanese Corp. of America has done at its new East Coast terminal at Newark, N. J. One of the nation's largest installations operated by an individual chemical company, it is on an 11-acre site along the Passaic River. The terminal has capacity for 4,000,000 gal. of liquid, 1,000,000 lb. of dry materials, and substantial packaging and drum-filling equipment.

Theoretically, all the different petrochemicals manufactured by Celanese at Bishop and Pampa, Texas, can be handled at Newark. Stored in 27 tanks and two warehouses, these materials can be delivered to customers by water, rail, or road vehicles in drum, tank car, tank truck, carload, or barge quantities.

Volume product receipts from Texas will come to Newark in the S.S. "Chemical Transporter," a 530-ft. tanker used under contract from Chemical Tankers, Inc. More than 1,000,000 gal. of petrochemicals will be shipped each trip. Products can be divided among seven compartments in the tanker with individual capacities ranging from 50,000 to 400,000 gal.

The ocean-going tanker is accommodated at a newly constructed waterfront dock, measuring 30 by 60 ft., with waterside dredged to a depth of 33 ft. From the dock, liquids are pumped to the proper storage tanks, and dry products sent to one of the warehouses.

The overall layout of the Newark terminal is shown in the accompanying drawing (next page). Approximately 15 miles of piping connect the various storage tanks and the loading points. For the connection between the two main sections of the property —on either side of Doremus Avenue —two 36-in. pipes were pushed under the 125-ft. width of roadways—a 75-ft. city right-of-way and a 50-ft. railroad right-of-way. This avoided excavations with resultant interruptions to traffic.

At present, there are 27 storage tanks and 28 motor-driven transfer pumps—with a combined pumping rate of 8000 gpm.—at the terminal. Six acres of the property have been developed. About half of the remaining 5 acres on the far side of Doremus Ave. is still available for additional tankage and other facilities.

All engineering for the terminal was done by the Celanese Chemical Division engineering department at Bishop, Texas. General contractor for construction was Damon G. Douglas Co., Newark. Tanks were erected by Chicago Bridge and Iron Works Co.

Product Purity

To minimize the chance of a customer receiving a contaminated product, Celanese installed a number of "purity safety" precautions at Newark.

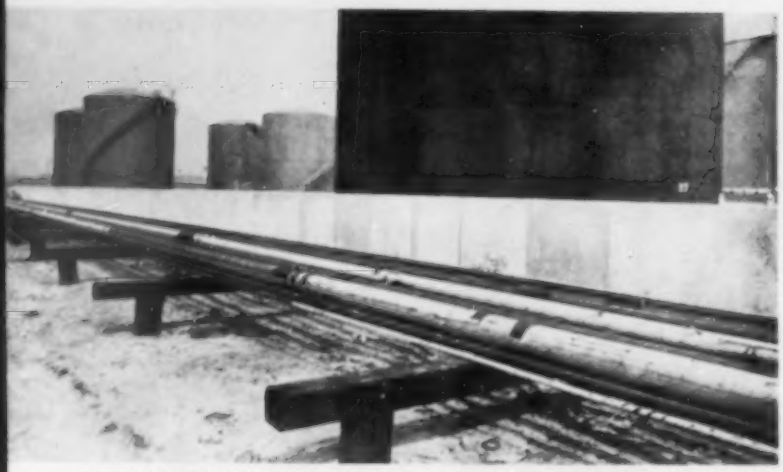
Special tank construction was used to prevent metal contamination during storage. For example, formaldehyde is stored in aluminum tanks with stainless steel piping. The inside surfaces of the glycol tanks are protected by a baked-on phenolic lining and all lines are of stainless steel. This is also true for the tank furnishing process and blending water to the area.

Acetic acid and formalin are also stored in aluminum tanks, the formalin tank being the fourth largest aluminum alloy tank ever erected. A number of the solvent and alcohol tanks are of stainless steel. The two "Formcel" tanks are insulated, and use continuous recirculation through an outside heat exchanger to prevent clouding and precipitation during storage.

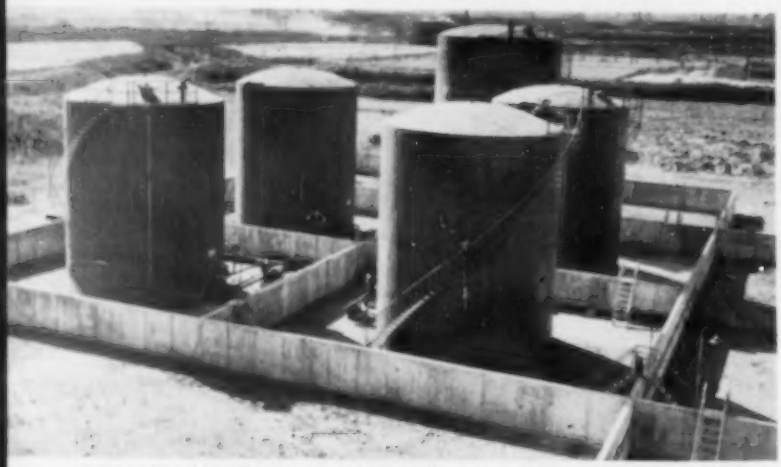
There is no inter-connection between storage tanks. Each tank has its own set of filling and discharge lines and transfer pumps. Product contamination due to incorrect manifolding, or leakage through valves between tanks, is therefore eliminated.

Quality testing on all incoming and outgoing shipments is conducted in a control laboratory equipped to analyze all products distributed through the terminal. Storage tank contents are analyzed frequently.

Storage tanks are single-purpose.



PURITY—Special tank construction prevents product contamination. Tank in foreground is aluminum: those at rear are carbon steel



SAFETY—Fires cannot spread: tanks are well-spaced and fire wall construction follows proper design principles

SERVICE—A 10-spot tank car loading rack provides for rail shipments. Additional racks (not shown) handle tank trucks

No more than one type of product is stored in one tank. Only under urgent need will the service of a tank be changed, because extensive cleaning of the tank and connecting lines would be required to prevent product contamination. Also, the labeled product lines and remote electrical control system would have to be revised for the change.

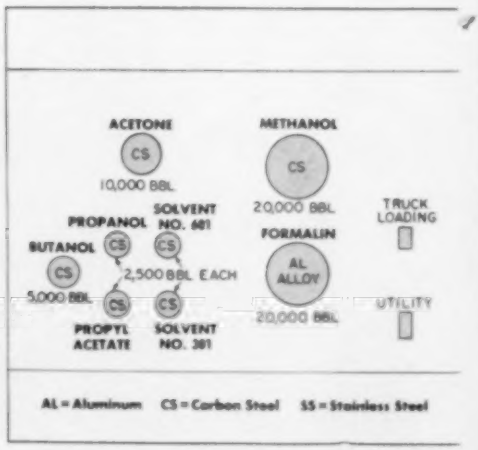
Safety

An extensive fire protection system in the terminal area has been installed, consisting of both water and liquid foam extinguishing systems. There are 13 hose houses located throughout the area. Each hose house has connections for either foam or water, hoses for these materials, and miscellaneous fire fighting equipment such as axes, etc.

An 8-in. water main supplies water to the hose houses. The pump for this system is rated at 1000-gpm, and 230-ft. head.

Liquid foam is supplied by two separate systems, one for each of the areas. Each chemical storage tank is equipped with a foam chamber and fixed piping connected to the foam generator. These are located at a safe distance from the tanks. This method allows an operator to apply foam to the surface of the liquid in any tank by pushing a button to start the foam pump and by opening one or more valves. This foam system is one of the most extensive programs ever installed using an alcohol type foam stabilizer.

Storage tanks are fitted with counterweighted aluminum explosion doors which direct the force of any internal explosion vertically and provide a safety vent to prevent the tank from



splitting at the sides. In addition, the tanks have flame arrestors to snuff out any small internal tank fires.

Customer Service

In addition to insuring uncontaminated products for the customer, the Newark terminal has several other features for speedy and reliable filling of orders.

All transfer pumps are actuated by a remote electrical control system which can be operated from stations at the pumps, at the tank car rack, the tank truck rack, and the barrel filling room.

A ten-spot tank car rack for both receiving and shipping chemicals, and additional trackage for holding full cars ready for shipment speed loading operations.

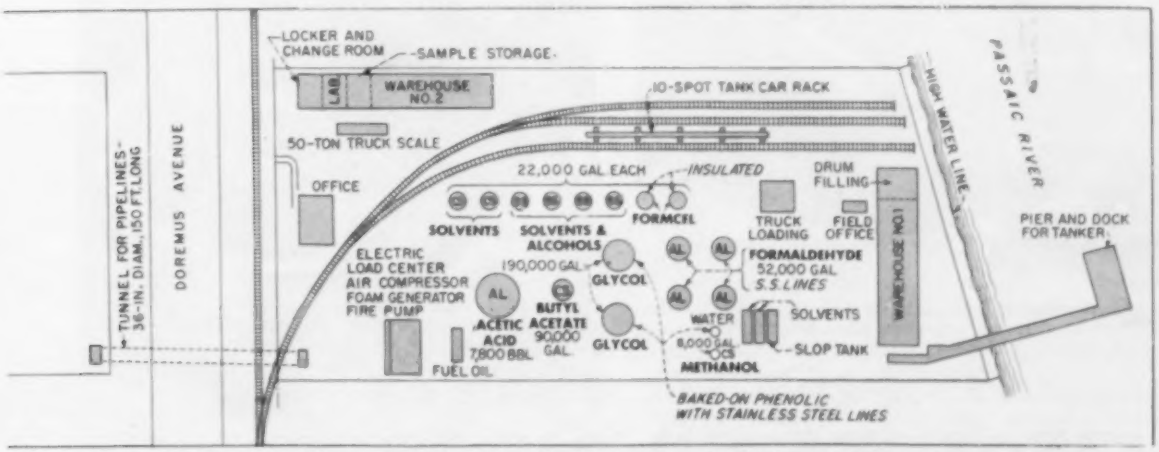
Two tank truck racks enable the terminal to load four trucks simultaneously. The tank car rack and one tank truck rack are equipped with counter-weighted drops to facilitate loading operations.

There are two warehouses for storage of dry products, such as "Paraform," trioxane, pentaerythritol, and drummed products. One has a truck dock for loading dry and drummed products and a dock along the railroad track for handling boxcar shipments.

Teletype linkage between the Newark terminal—the nerve center for the entire national distribution system of Celanese's Chemical Division — will serve to control both delivery and inventory programs at the other Celanese terminals and warehouses now located at Carteret, N. J.; Chicago, Ill.; Oakland, Calif.; and Corpus Christi, Texas.

SERVICE—Palletizing and fork-lift trucks speed flow of dry products in and out of one of two warehouses.

SERVICE—Small quantity packaging: a drum loading station at Newark makes ready a shipment of n-propyl acetate



PLENTY OF ROOM for a carefully planned terminal in the 11-acre site, of which about six acres are in current use

Are Your V-Belts Tight Enough?

Here are some tips in words and pictures on practical ways to get proper tension

By FRANK H. RUMBLE
Allis-Chalmers Mfg. Co.
Milwaukee, Wis.

IN TODAY'S multiple V-belt drives the strong grip of the sheaves on the belts permits use of less belt tension than is required by round or flat belts. The wedging effect of V-shaped belts in V-shaped grooves provides more friction than the simple surface contact of other drives.

Unfortunately, this better grip can cause trouble. The amount of grip can be overestimated and too little tension applied. Experience shows that there are a great many more V-belt drives operating with insufficient tension than with excessive tension. Drives with slack, sagging belts almost always need more tension. Proper adjustment will often remove the sag and provide more uniform and efficient operation.

A V-belt drive must have *some* tension on the belts to operate correctly and assure longest life of both belts and sheaves. Otherwise the belts will slip while in use, quickly wearing both belts and sheave grooves. Also, slack belts sometimes "whip," jerk, and do not operate in unison.

What then is the correct amount of tension for V-belts and what is a practical means of attaining it? Before attempting to answer these questions, let's examine a few other facts.

▲ **SLAP THEM** with the palm of your hand. They should feel springy and alive. Slack belts feel dead

STRETCH THEM on installation. Move the motor ½ in. for each 100 in. of center distance. Note chalk marks ▶

PRESS THEM one at a time. An OK belt can be depressed a distance equal to its thickness in a 48-in. span

Like a pair of new shoes, V-belts need a "breaking-in" period when first installed. Over their useful working life, standard V-belts of rubber, cord, and fabric will show a total stretch of approximately 4%.

The stretching is gradual and may only become apparent after the belts have been under proper tension for a relatively long period. However, a small amount of this stretch occurs soon after belts have been installed and before they reach their working length. After this initial stretch is removed the belts resist further "give" and retain a large share of their elasticity.

It is possible, of course, to put so much tension on a V-belt drive that the belts themselves will be "tight as fiddle strings." As a result, the belts will be stretched unduly and the bearings of motor and driven machine overloaded and damaged. However, this danger is not too great and is not frequently encountered unless excessive tension is applied deliberately and without reason.

For the average properly engineered drive, it is necessary only to apply enough tension to prevent slipping of the belts under full load. Slippage can readily be detected by use of a tachometer applied to driver and driven sheaves.

If excessive tension is required to keep the belts from slipping, the engineering of the drive should be checked. Perhaps the drive should have sheaves of larger diameter, or more belts. High capacity type belts may offer a solution.

The phenomenon of belt sag is well known but not too well understood. Sometimes, a few belts in a matched set will sag more than the rest, and appear much longer. This happens in matched sets which have been in use, and frequently, also, with newly installed matched sets.

In today's method of matching V-belts, the maximum difference in length between longest and shortest belts in the set is only 1/10 in. per 100 in. of belt length, or 0.1%. The amount of sag this may produce is deceiving. On a center distance of 100 in. on drives with both shafts parallel to the floor or base, a sag of 2 in. in a belt will appear drastic. Yet it can be removed by only 0.054 in. of take-up on the motor base—less than 1/16 in.

Stretching the shorter belts in the set so slightly to make them equal to the others will not harm them. In fact, considerably more than this amount of stretch must be applied to all belts in the set. Research has shown that V-belts operate best when under slight stretch, which is, of course, induced by putting them under tension. That's the reason the belts are made resilient and elastic —a necessary characteristic of V-belts working in multiple. Belts under proper tension are operating under approximately 0.5% stretch.

In the average shop or factory it is impractical actually to measure the pounds of tension which are applied to a V-belt drive. This is usually done in the laboratory with special equipment. Exact measurement is not necessary. It is sufficient to have practical ways of approximating the correct tension. The experienced operator can tell by observation and feel whether or not a set of V-belts is under proper tension. Unless the drive has an unusually long center distance, the belts under proper tension have little, if any, sag. A slack V-belt feels dead when thumped with the hand; a properly taut belt has an alive springiness.

Check the rpm

There are other ways of judging whether or not a V-belt drive has the proper tension. One is to use a tachometer, as previously mentioned. After a set of belts has been installed, all the slack removed, and the drive started up, the rpm of the driver shaft can be checked with the rpm of the driven shaft according to speed ratio. Tension should be applied only to the point where no slippage is evident. The procedure should be repeated every few days until the belts are broken in and properly set.

Press Them

Another method, favored by some operators, is to depress the belts (see drawing). With the drive stopped, press down firmly on each individual belt. A belt which can be depressed an amount equal to its own thickness for each 48 in. of unsupported length is properly tensioned. This allows for the fact that the larger the cross section the greater the amount of tension required.

Where 48 in. of unsupported length is not available, a proportional amount of pressure should be exerted.

Stretch Them

Still another way of quickly attaining the approximately correct tension when installing a set of belts is this: after belts are properly fitted in the grooves, move the motor away from the driven machine, to the point where belt sag is eliminated. Indicate the exact center distance by making a chalk or pencil mark on the motor base.

Then make an additional takeup of ½ in. for each 100 in. of center distance (see photograph). Proportionate takeup should be made on longer or shorter center distances. This will approximate about 0.5% stretch and put the belts under the proper tension.

Belts should be checked after the first few days with the "hand thumping" or "depressing" method to be sure they have not loosened up. If so, more takeup will be required.

RADIOGRAPHY REVEALS several potential failures in the lining and shell of a tower, whereas . . .

Radiography— a Maintenance Tool

By V. P. BRACKEN and W. SKIBA
Esso Standard Oil Co.

RADIOGRAPHY can provide a long-needed maintenance tool for spotting possible failures in lead-lined process vessels. A technique developed at Esso Standard Oil Co. has worked successfully on a 36-ft. tower in sulfuric acid service.

Relatively simple to do—all you need is a good source of radiation and means for holding the photographic plate—we have found our technique has these advantages:

- The vessel did not have to be torn down.
- Offstream time was short, product losses small.
- Tiny defects—not easily detected by ordinary observation—were caught before they could cause trouble.

The technique is also applicable to quality control inspection of many types of lead-lined equipment during fabrication. Had such an inspection been made on our tower, downtime would have been completely eliminated and expensive maintenance avoided. Cost of this inspection would have been $2500—about 4½ % of the vessel's installed cost.

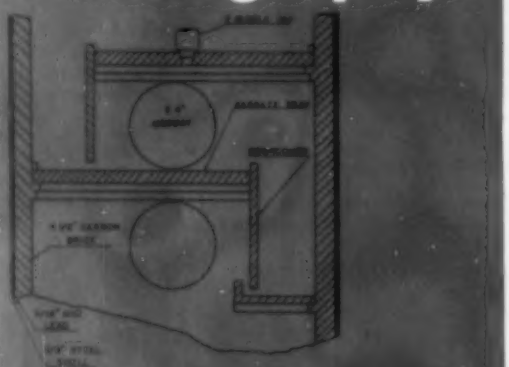


FIG. 1—Internal construction of a lead-lined tower (above) with detail of manway (right)

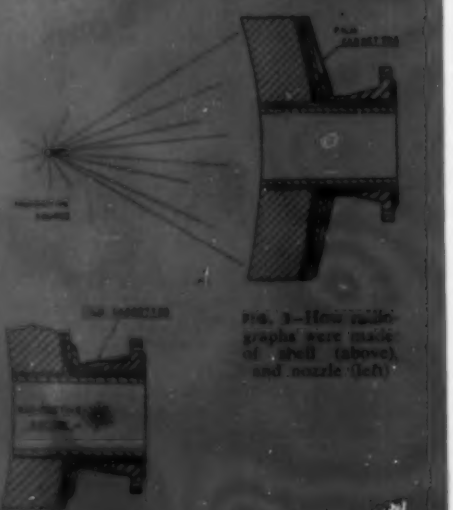


FIG. 2—How radiographs were made of shell (above) and nozzle (left)

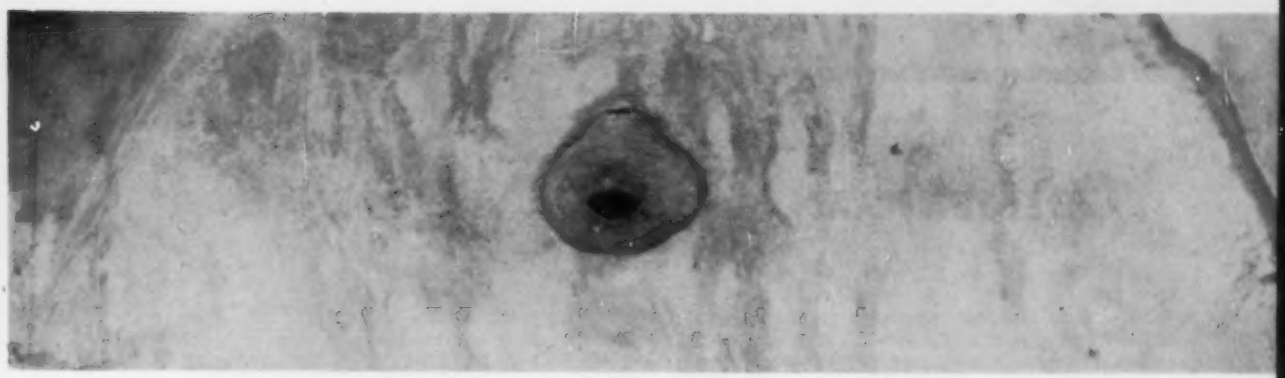
The Problem and Possible Solutions

Failure of the lead lining occurred in a 36-ft. tower of seven feet diameter, handling 45% sulfuric acid at 275° F. The initial failure, near a 24-in. manway, was repaired by removing a Karbate sleeve and surrounding carbon brick (see Fig. 1). The corroded hole was welded and the lead lining rebonded. Later failures were temporarily patched with Alkor cement.

However, after five similar shell failures in the first four months of operation, full knowledge of the liner's condition was needed. Production demands would not allow a long downtime. The normal acid-etch inspection would have required 5 to 6 months for removing the tower internals and the carbon brick lining. Therefore, a rapid, accurate, and nondestructive inspection was sought.

Three methods for nondestructive examination of the lead lining were available: (1) dye penetrants, (2) radioactive tracers, and (3) radiography.

Dye penetrants were rejected because their use would require removal of the tower internals—the same drawback which eliminated the acid-etch technique. Use of radioactive tracers was also rejected because of the high level of radioactivity required. The only method left was



CONVENTIONAL PHOTOGRAPHY or ordinary observation shows only this hole in the lining and the shell

for Lead Lining Inspection

radiography. Because a search of the literature revealed no information on its application to this problem, a practical radiography technique was developed.

Developing the Method

The technique for this application was developed in the laboratory by making a radiograph of a test plate which showed its feasibility. This plate consisted of a ¼-in. lead sheet laid on a ⅜-in. steel plate, with different diameter holes drilled to various depths in the lead overlay.

An exposure was made using a Cesium-137, 5-curie source and du Pont's Type 506, fine grain film, with a source-film distance of 36-in., and exposure time of seven hrs. The resulting radiograph clearly showed tool marks, surface markings, and the holes. Other successful test exposures were made with carbon brick over the test plate.

For the field test in the actual tower, a portable 250-kvp. X-ray unit was used instead of a radioactive source, because X-rays require shorter exposure time. Excellent correlations were obtained between radiographs and actual defects. The smallest honeycombing, crack, hole, or slag inclusion was uncovered.

Field Application

The next step was a systematic inspection of the entire tower. Because of the bubble-tray spacing and the large areas to be examined, radioactive isotopes were used instead of X-rays, resulting in gamma-ray radiographs. Another reason for using isotopes was that X-rays required excessive exposure times due to brick water absorption.

Fig. 2 shows how radiographs were made of shell areas near manway necks. The radioactive sources and strengths used were Cobalt-60, 500 millicurie; Iridium-192, 2 curie; and Cesium-137, 5 curie. Films were du Pont Type 506, Eastman Kodak "No-Screen," and Ansco "A," at source-film distances to 36 in., with 12-hr maximum exposures.

Fine grain film was preferred because larger film grain prevented definition of small defects on the gamma-ray radiograph.

An important factor in determining exposure time was the composite thickness of the lead, carbon-brick-lined vessel (equivalent to 3¼ in. of steel). Film exposure holders of 14 x 17 in. size were placed near the 24-in. manway. By adjusting the location of the radioisotope for proper source-film distance, all film around a single manway was exposed simultaneously. Match marking of the overlapping film permitted accurate defect location. Shell areas around all nozzles were radiographed in this way.

Spot checks of lead linings in other shell areas were made individually—or at the same time with manways.

To radiograph manway and nozzle-neck openings, the other method shown in Fig. 2 was used. The source was placed in the center line of the opening and the film holders were wrapped around the neck. Because of the short source-film distance, exposure time was about 10 to 15 min., when Cesium-137 was used.

Meet the Authors

Mr. Skiba

Mr. Bracken

Mr. William Skiba is an engineer in the equipment inspection division of the Bayway refinery of Esso Standard Oil Co. He obtained his B.M.E. from Brooklyn Polytechnic Institute in 1952 and is an associate member of the American Society of Mechanical Engineers.

Mr. V. P. Bracken is supervisor of the equipment inspection division at Bayway. He received his B.S. in M.E. from the University of Pittsburgh in 1942. Since then he has completed assignments at Baton Rouge, La., and Antwerp, Belgium, for Esso.

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For Instrument Maintenance

Centralized Shops Are Better

NOW, for the first time, Gulf Oil Corp.'s Port Arthur, Texas, refinery has a centralized instrument repair set-up. This has permitted a reorganization of the instrument department. And Gulf expects the resultant savings to more than justify the construction and equipping of the new building.

Although it's too early to estimate actual dollar savings, they show promise of being substantial. The chart below shows some of the justification for the new arrangement.

Like many others along the Gulf Coast and elsewhere, the Port Arthur plant "just growed." So did its instrument department: from the days when instruments first were substituted for hand control up to the present dependence on the latest electronic equipment. At first, it was easier to locate the instrument storage close to points of use. This practice continued until the complexities of modern instruments and of the refinery itself made it inefficient and unsatisfactory.

Decentralized operations made it difficult to keep tabs on stocks of instruments and repair parts. They were scattered among the five different points in the refinery which corresponded roughly to processing unit arrangements. Because of this, and the difficulty of quickly locating a needed part in cramped quarters, there often was considerable duplication of stocks and frequent damage from handling in storage. Furthermore, several process unit supervisors decided to stock certain instruments for their specific processes and; a few also kept spare parts.

This developed because the instrument department occasionally "got caught" with depleted stocks of a few parts needed for emergency replacements. Today, these unit operators have learned to "trust" the reorganized instrument department. This practice has been eliminated and the extra parts have been transferred into regular stores.

Work had not been too efficient, as control valve maintenance demonstrates. Only a small stock of usable control valves was kept on hand because of lack of centralized facilities and generally inadequate shop space. When a process unit was brought down for maintenance — practically every week in a refinery of this size— the control valves could be given attention only in the field in most instances.

Today, a backlog of repaired valves is on hand and unless there is some special reason for making field repairs valves come to the shop for attention.

Instruments had been cleaned out-of-doors. Sandblasting in protective clothing in Port Arthur's humidity is so uncomfortable that the job was despised and avoided whenever possible.

Workbenches were narrow—inadequate for handling modern instruments. There were no permanent set-ups for calibrating various types of meters and gages; usually these were rigged-up for each job as required. These things did not make for the most efficient operation; and they did not improve employe morale.

These conditions made the new shops building necessary even before the department itself could be reorganized for greater efficiency. Likewise, using the new building *required* instrument department reorganization. The department now reports to the

WHAT CENTRALIZED INSTRUMENT MAINTENANCE MEANT FOR GULF

Before	After
Five different locations for instrument repair and storage, each one in extremely cramped quarters.	**One central shop building,** a one story structure measuring 70 x 168 ft., including all storage, repair, and office area.
Unnecessary duplication of item storage at several points. Some stocks also at process units.	**Single storehouse** for all instruments and repair parts, centrally located in the refinery.
Repairs were inefficient, as indicated by the large backlog of orders waiting completion.	**Shop efficiency increased** by proper tools and equipment in a well planned and laid-out work area.
Time loss was high as workmen had to find the equipment they needed and get it to point of use.	**More time spent on job,** as workmen spent less in-plant travel time hunting parts and tools.
Supervision difficult and inefficient because of lack of personal contact with "divisions" within the instrument department.	**Supervision efficiency was boosted** as various foremen were able to maintain close contact with their crews in centralized shop.
Worker morale low, as men were dissatisfied with equipment and inadequate working space.	**Worker output higher** as morale was raised when workmen had the kind of shop and tools they needed.
Training was extremely difficult because formal classroom facilities were not available.	**Improved training** provided by new classroom for instructing both old and new employes.

superintendent of construction and repair. Formerly it reported directly to the general plant superintendent.

The New Shops

The instrument shop building is unusually large, providing almost 12,000 sq. ft. of enclosed floor space. Basically there are two shop areas, two storage areas, a cleaning area, a class room, and administrative offices.

Although this refinery includes extensive petrochemical operations, no differentiation from strictly "refinery" instruments has been made for physical maintenance and handling purposes. (The accounting procedures which may be involved are beyond the scope of this discussion.) Most of the petrochemical plant instruments are of the miniature type. The refinery on the other hand usually has only standard sized instruments. This makes some differentiation possible at a glance.

A prominent feature of the building is its tile walls. These combine with the concrete floor to provide maximum cleanliness and utility. Strips of fluorescent floodlights throughout give excellent visibility even on dark days. Except for such unusually close work as clock repairing, no supplemental lighting is necessary. The only floor paved with wood blocks is the main shop repair area where the men spend most of the day on their feet.

The offices, classroom, and the pyrometer and clock repair room are air-conditioned. Positive draft fans provide the rest of the building with adequate ventilation. The shop building floorplan is shown in the drawing. The building can be described by following the progress of a hypothetical instrument.

An instrument enters the building through an areaway which marks the terminus of a 2000-lb. monorail crane line. The line extends from the entrance sufficiently to allow direct unloading (or loading) of a truck.

The instrument lands in the temporary storage and receiving area, from which it may go directly to the store room if it is a new instrument or part, or to cleaning if brought in for repairs. An instrument or a control valve might be cleaned twice: once superficially, if necessary, for ease in dismantling to determine the nature of required repairs, and again, so that the external parts can be cleaned of old paint and other incrustations. A chemical cleaning agent, or various solvents, are used.

Unless the instrument is a pyrometer or has a clock needing repair, it is shifted either to the regulator repair or flowmeter, gage and miscellaneous repair sections of the main shops. Usually, as soon as the elements are out of the case, the case is shunted back to the cleaning room where the bulk of the paint is removed by chemical cleaning and degreasing in a steam-heated cleaning bath.

Often paint and dirt are not readily removed by chemical or solvent cleaning. Formerly, it was necessary to finish-clean by hand with wire brush and chisel, and often easier simply to paint over stubborn incrustations. Hand-cleaning has now been eliminated. Every rebuilt instrument leaves the shops looking "factory fresh."

Why all the "spit and polish?" The department has found that much less trouble is caused by an instrument which has a nice glistening coat of paint. But, the same works in a scratched and dented case is often blamed for causing trouble at the unit where it is installed. Newly-painted instruments seldom generate as many "trouble-calls" as those showing signs of wear. Therefore, the department tries to make rebuilt instruments look as nearly new and professionally finished as possible.

One of the proudest possessions of the department is an "American Wheelabrator" shot-peining machine. It has completely eliminated sandblasting; and does a better job in many ways. It saves time; there are practically no safety hazards in its use; protective clothing is not required; and for instrument work the quality of cleaning is the equal of sandblasting.

Two or three large instrument cases can be cleaned at one time, in about 10 or 15 minutes. Bodies of ten or twelve control valves can be cleaned simultaneously in 5 to 10 minutes. It is practically automatic in its operation, and intensity of peining is readily controlled by the operator — even though he cannot see the work—by varying the power fed to one of the motors.

Once cleaned to bare metal, the instrument is only a step away from the paint spray booth, from which the case will emerge looking like a new

Major Responsibilities of Port Arthur Instrument Department

1—Exercise control over the installation, use, and care of all indicating, transmitting, recording, and/or controlling devices for the measurement and control of process variables.

2—Accept responsibility for the accuracy and reliability of information obtained from the instruments. Establish routine inspection and maintenance programs to assure continued accuracy and forestall failure, and to minimize delay in effecting corrective repair.

3—Provide assistance to operating personnel in analysis and use of information obtained from the instruments, and in analyzing process control difficulties.

4—Revise range, use or function of existing instruments to suit changed operating procedures for desired process control.

5—Provide experience and guidance to other refinery departments in the application, selection and installation of instruments in new projects.

6—Coordinate companion crafts concerned with installation and maintenance of instrumentation.

7—Cooperate with other departments in preparing for and conducting material balances, heat balances, operational surveys, plant performance tests and the like.

8—Devise new instruments or adapt existing ones to meet non-standard requirements, special applications and unforeseen conditions which render use of standard items ineffectual.

9—Instruct operating personnel in the functions, limitations and uses of instrumentation.

10—Keep abreast of technological improvements in instrumentation and process changes contemplated by management and recommend to management where substitution or installation of late equipment would be desirable and economically justifiable.

11—Maintain an adequate supply of all instrument charts, change charts on recording instruments and maintain a file of used charts for a reasonable length of time.

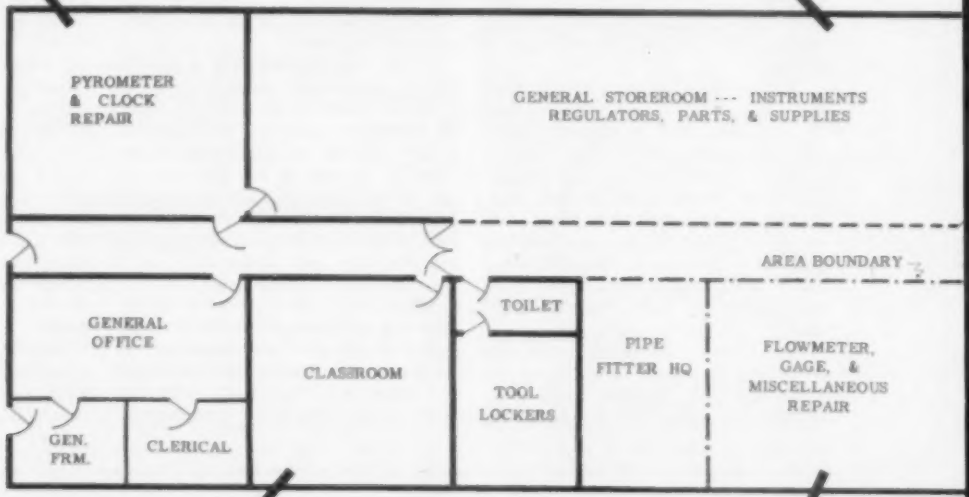
12—Prepare, install and keep current all meter constant stickers.

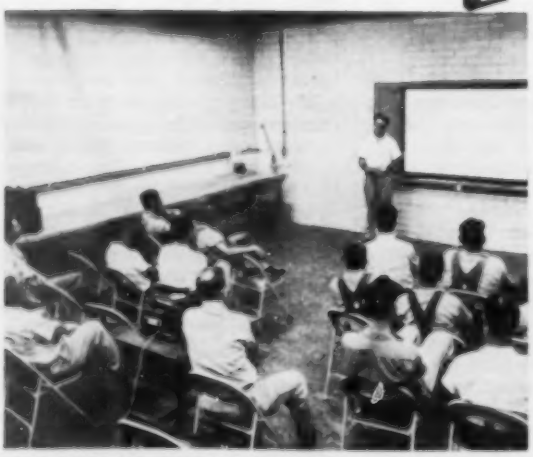
13—Maintain staff and facilities to discharge responsibilities under the foregoing.

1 —**PYROMETER AND CLOCK REPAIRS** are made in separate room with special, small test equipment

2 —**GENERAL STORES AREA** provides plenty of space for various sizes and types of equipment

EFFICIENT LAYOUT was result of new centralized instrument shops building

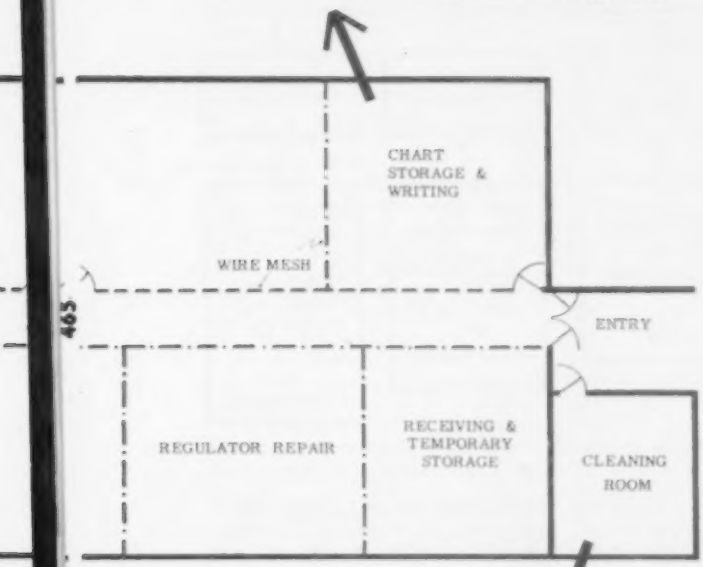




4 —**CLASSROOM**—school bells ring for 16 men trying out for the first-class instrument man rating

5 —**MAIN WORK AREA** is spacious, approximately 3000 sq. ft. of area, and has plenty of room to move around in

3 —**CHART STORAGE** uses neat, easy-to-get-at shelving for clean storage of charts, with wide access aisles



6 —**CLEANING ROOM** with spray painting booth at left and shot peining machine at right

model off the show-room floor. The case then is routed to the proper part of the shop to have its "works" re-installed.

Conventional equipment, for the most part, is used in the flowmeter, gage, and miscellaneous section of the shops as well as in the regulator section. These shops are equipped with a 100-in. manometer, deadweight tester and standard gages, vises, a few special jigs which some of the men have developed, and an oil bath for check-calibrating thermometers. The last mentioned has permanent thermowells of various sizes, in sufficient variety to accommodate most thermometers and bulb-type instruments used in the refinery.

Two pipefitter gangs also headquarter and keep their supplies in this portion of the instrument shops. These men work full-time on pipefitting work created by instrument department installations and dismantling work orders.

Unusually strong workbenches are installed in this and other parts of the shops. They are made of 2-in. thick, laminated hardwood tops, supported every 4 ft. with strong steel legs. In most cases, heavy shelving underneath is used to store parts, tool kits and the like. Each 4-ft. section also has one large drawer, which may be locked.

This shop also makes thermocouples and has a small acetylene torch outfit for the purpose. Better quality control of thermocouples has resulted from the new arrangement. No other welding is done by the department, however. Any equipment requiring this type of repair is sent to the regular refinery welding shop.

There are neither machinists nor machine tools in the instrument department. Any machine work too heavy for a jeweler's lathe is sent to the main mechanical shops. An example is the installation of new seat rings in a control valve. The instrument department will supply the new seat and plug if required. However, a machinist will install and do any necessary lapping-in.

If the instrument is a pyrometer, it is routed to the pyrometer repair area, the only air-conditioned shop in the building because of the precision work involved. The clock repair section of the pyrometer room will handle the clocks of other types of recorders.

The pyrometer room also handles all electronic-type instruments. The electrical and electronic test benches, located here, contain the usual instruments — multimeters, tube testers, standardized batteries and others— to test electrical circuitry. There are also several specialized test benches.

One such test bench is designed to

test either of two makes of amplifiers common in the Port Arthur refinery, as well as the balancing motors for these electronic instruments. It is home-made but effective. The amplifier is connected, power applied, and a synthetic signal fed to it. A test motor should turn in the proper direction. Or, the suspect motor may be installed and checked with an amplifier known to be good. The direction of rotation and balance position may be observed and the breakaway torque of the motor—developed force necessary to move the pen carriage to the required recording position — may be measured rather exactly.

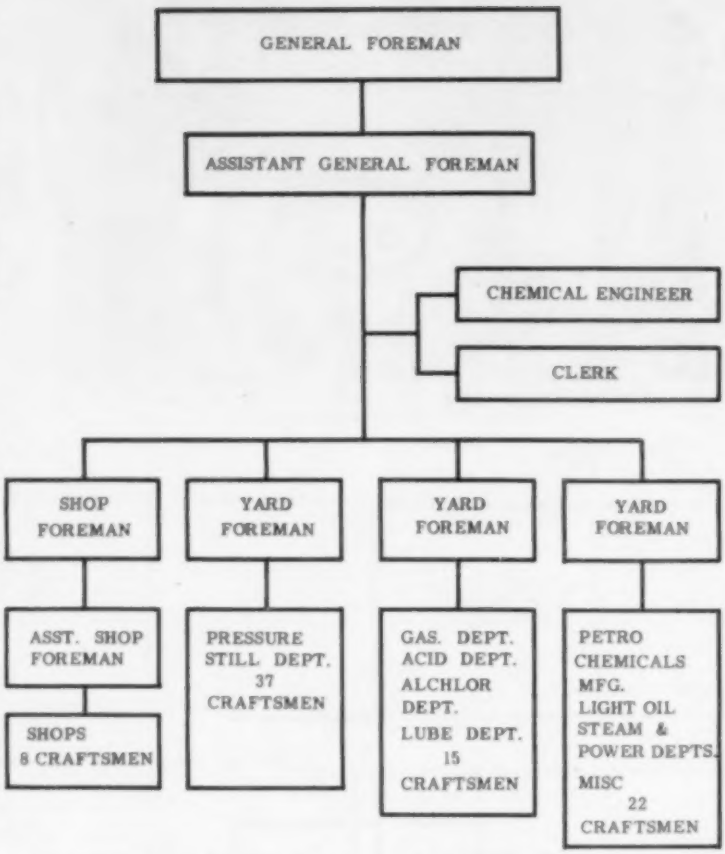
Another feature of this part of the shop is a 100-in. water column and mercury filled columns for the greater ranges. These columns are operated with controlled air pressure and so manifolded that it is simple to rig them to test any type of flowmeter and transmitter found in the refinery.

An important function of this shop is the conversion of mechanical type pyrometers, especially but not exclusively, into the latest type of electronic instruments. The procedures and techniques have been worked out by shop personnel and the overall cost is considerably below the delivered price of a new electronic instrument. The shop is very proud of its demonstrated ability in this work.

Anything from stop watches to punch clocks can be repaired in the clock section. The equipment is conventional, however.

The storeroom area actually is divided into two parts, one for general storage and the other for charts and chart-writing. These are separated from other areas by wire netting. In the general storage area, also served by the monorail crane, extensive use is made of revolving bins for small parts, and drawer-filled cabinets for special parts which should be kept free from dust. There is the usual shelving and bins made of sheet metal. Ample room for handling and locating the various items is available, and a perpetual inventory system is being installed as rapidly as possible. This system, plus experience to be developed over the next year or two, is confidently expected to permit cutting capital tied up in repair parts inventory by at least one-third. The consolidation of stocks from the five former instrument shops has already permitted noticeable reductions in unnecessary duplications.

The chart storage and writing room is separated from the main storage area and the shops by wire netting. Supplies are kept here of charts for all the instruments in the refinery and, in addition, labeled charts for all instruments using circular charts. (Most charts are changed only by instrument men in this refinery.)



OVERALL ORGANIZATION of the Port Arthur instrument department

Pre-identified charts are used, on which an Addressograph imprint is made identifying the instrument, the color code for each trace if more than one pen is used, and the appropriate meter factors. The chart also is predated.

A three weeks' supply of marked charts—60,000 of them—is kept on hand at all times. After being imprinted, the charts are placed in carrying cases in the precise order in which the instruments will be met on the chart-changer's routes. The used charts, of course, are delivered to the proper departments for reading and filing.

The classroom, across the hall from the pyrometer shop, is intended for formal classroom work and general assemblies. It will hold 75 people comfortably, and double that number can be accommodated by judicious "squeezing." It is equipped with power outlets about every 4 ft. around three sides, and the same type of workbenches that are in the shops. Air and water are also supplied. At one end is a blackboard and a screen for slides or movies. There are plans for a permanent display of various basic instruments now being developed, and also for the accommodation of demonstration instruments from suppliers. The room also houses an engraving machine used to make new nameplates for instruments whose services are changed.

The department is assigned a pickup truck and three three-wheel "Cushman" scooters. A number of the men who must travel considerable distances regularly also are assigned bicycles. The truck is used for transporting the pipe gangs and their equipment from job to job, and to carry jobs to the various mechanical shops for welding, machining and the like. One of the scooters is on the gas meter route, another, on the steam meter route. The third is normally used on turnarounds, shuttling between shop and

shutdown unit. When not occupied with regular work, they are available to departmental personnel as needed.

The Personnel

The instrument department employs 92 men. Eight are line supervisors, two are in staff positions and 82 are craftsmen in one of three categories. The organization chart shows the four major divisions. The manpower of each subdivision also is shown, but this is indicative, not actual, because men are assigned as needed. They may change from day to day.

Men are assigned to operating departments rather than geographic areas as such. However, assignment by operating department is almost the same as area assignment.

Two pipefitter gangs, each consisting of a pipefitter and three helpers, are permanently assigned to the instrument department and have their headquarters there. They work exclusively on pipefitting assignments developing from instrument department work orders. These men report, however, to their own supervisors, and not to instrument department supervisors. They do all the pipefitting which instrument installations require and thus become especially skilled in the particular requirements of this work. They are given extra temporary help as special work needs dictate.

The responsibilities of the instrument department at the Port Arthur refinery are shown in the accompanying box.

The instrument department does not have any responsibility for setting, or the maintenance of, such items as safety and relief valves, or displacement-type flow meters. These "instruments" are the responsibility of the mechanical shops. Likewise, the instrument department does not handle voltmeters, relays, circuit breakers and alarm switches. These items are within the purview of the electrical shops.

Laboratory instruments are not handled regularly. These instruments are very highly specialized and the applications frequently change. Therefore, the instrument department acts in an advisory capacity to the laboratories and will, upon direct request, undertake to repair those laboratory instruments most nearly resembling commercial instrumentation. Some commercial-type instruments, of course, are used in the laboratories and these will be serviced by the instrument department if asked.

The instrument department does no installing of instruments, except for setting and fastening in place after other crafts provide mounting arrangement. It merely repairs, maintains and tests them. Pipefitters, for instance, run pneumatic transmission lines to and from an instrument, and install the plate and piping for an orifice flow meter. The electrical department furnishes the power supply for an electric or an electronic instrument, terminating the wiring at the nearest power receptacle serving the instrument or the terminal block inside the case. The instrument department installs a thermocouple in an operating unit, but the electrical department runs the transmission line (wire for which is stocked and supplied by the instrument department) from the thermocouple junction box head to the pyrometer terminal block. Bulb-type pyrometers are installed by the instrument department, since special precautions must be observed with the bulb; this does not include stem-type thermometers, installed by pipefitters or instrument men.

Training Activities

There are at present three classes of craftsmen in Gulf's instrument department at Port Arthur. The Third Class instrument man actually would be called a "helper" in most crafts, although here he does many jobs alone. The Second Class instrument man is a recognized craftsman but without extremely varied experience and responsibility. A First Class instrument man is a fully-qualified craftsman, able to handle any type of instrument repair performed in the refinery. The term "apprentice" does not apply to the instrument department because no men may be hired directly into the department from outside the company.

Fledgling instrument men in Gulf's training program are called "trainees," and under this program an instrument department opening is filled either by bid or selection. That is, 50% of the job openings must be filled by bid from men in the plant on a seniority basis, (with first choice to Instrument Department personnel) and the other 50% by selection from those who have expressed interest in joining the department but whose seniority is not enough to give them a chance to get in by bid.

The prospective trainee, arriving by either the bid or selection route, is required to take six aptitude tests and make a minimum score. One test indicates reading ability, another his adaptability. These are followed by two arithmetical tests, one mechanical aptitude test and, finally, a mechanical comprehension test. If the man makes the required minimum score, but in doing so fails no more than one aptitude test, he can retake that test. If he misses again, he's out.

Once accepted as Trainee, and providing he applies himself, he is in for up to four years of training—based on the departmentally-accepted experience he may have acquired previously. By the end of this time he should be First Class Instrument Man. The training program an individual trainee undergoes is thus tailored to his needs.

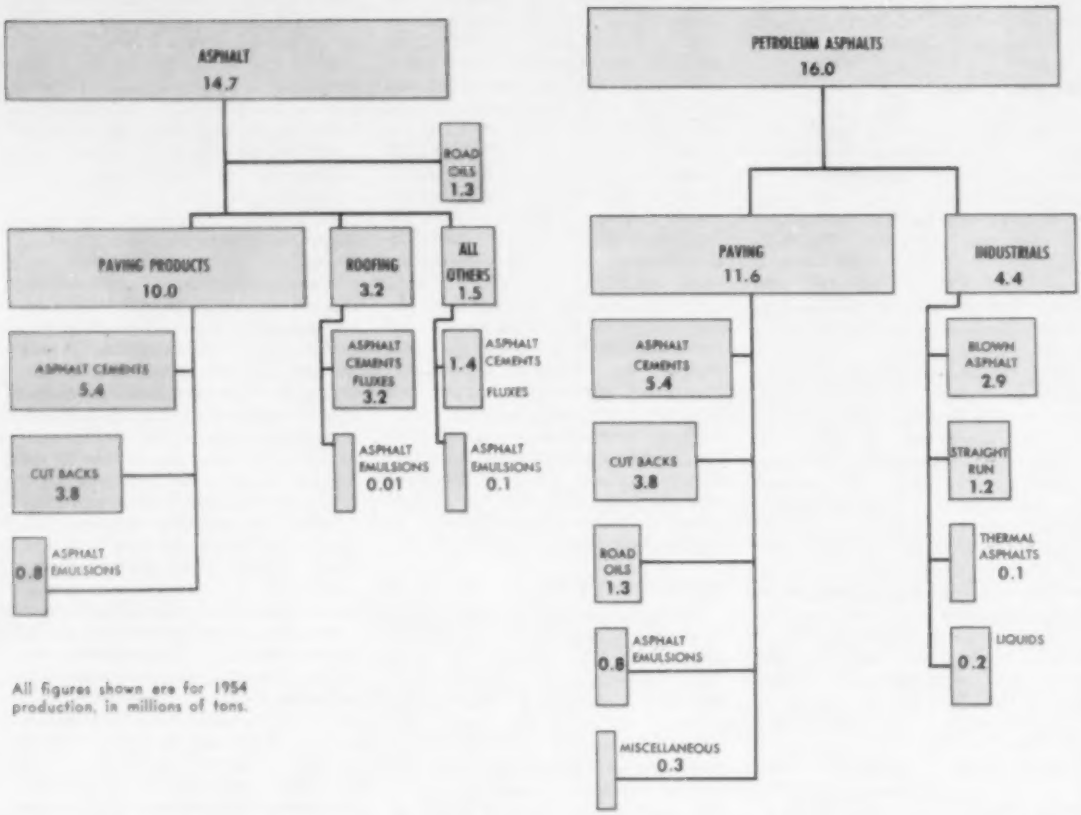
The training en route to First Class rating involves an International Correspondence Schools instrumentation course, which the trainee completes on his own time and at his expense, plus a number of company developed courses which are taken on company time. At the time of the writer's visit to the department, the 18 men in the training program were just starting a course in electronics with particular emphasis on amplifier circuitry. The teacher is one of the shop foremen. These men have Third Class, Intermediate, or Second Class ratings and are in training for their First ticket.

Initially, a commercially-available talking film strip is being used for the first 12 lessons. Later, specialized film strips produced by instrument suppliers will be used. The course will be topped off by several special lessons relating to in-plant equipment which have been developed by department personnel in cooperation with the refinery's training department.

At the present time the instrument department has 50 First Class instrument men. Eighteen men are in training for First Class; there are nine Second Class men and five Third Class men besides those in training.

The instrument department observes a five day week. One man is on duty in the department around-the-clock, however, and several are available for "off-shift" and Saturday and Sunday special work. In the past three years, during which a great increase in refinery size and the number and complexity of its instruments has taken place, the department has been taking in an average of four men a year.

It speaks well for the instrument department that it has no trouble in securing personnel when it needs them, despite the tribulations of recent years. There are always more bids than there are openings, and the men are of high caliber. On the other hand, contrary to the experience of many other departments, a bid to get *out* of the instrument department is practically unheard of. This is not because the work is a lazy-man's dream but because the work is interesting and supervision is excellent and understanding.



MORE USEFUL DATA on production and sales is feature of new system classifying asphalts according to end use

More Useful Data from . . .

New Asphalt Classification System

By L. W. CORBETT

Miller-Warden Associates
Swarthmore, Pa.

WITH the growing use of asphalts has come an urgent need for much more useful data on production and sales. Especially needed is an improved classification system. This article describes a relatively simple system (see chart) based on division of all petroleum asphalts into two groups according to ultimate use: paving asphalts and industrial asphalts.

Paving asphalts are those of all consistencies used for roads, airports, and other traffic-bearing surfaces. Included are asphalts used for soil stabilization, joint sealing, undersealing, and dampproofing, as well as those used for the paving itself.

Industrial asphalts are asphalts of all consistencies used directly or in compounded form in industrial products and construction products not included in the paving group.

The proposed system offers four important advantages:

1—The asphalts are broken into two groups with all types specifically accounted for.

2—Each type appears in only one major classification.

3—The system is applicable to any method of record keeping or reporting.

4—Road oils are classified logically.

Detailed specifications of the proposed system are shown on the facing page. The article continues on page 1898.

Detailed Classification of the Proposed System

Paving Asphalts

1—Asphalt cements are those asphalts which have a penetration at 77° F. (100 grams, 5 seconds) in the range of 40-50 or 200-300 or any intermediate grade. By definition, all asphalt cements are semi-solid in consistency.

By far the largest group of asphalt cements are straight run products; that is, they are vacuum or steam distillation residuums from asphaltic crude oils. Asphalt cements may be prepared by air blowing a low viscosity crude residuum, or they may be blends of a blown product with a straight run product. They sometimes contain asphaltic fractions obtained by solvent precipitating or solvent extraction of viscous crude oil stocks. Occasionally they may be made up of thermal cracked asphalts or blends of thermal with straight run stocks. These cements may also be made by adding powdered asphalts to aggregate mixes which are then subsequently fluxed with liquid oils or asphalts.

2—Rapid curing cut-backs are liquid asphalts made in different consistencies or viscosities to permit convenient spraying or mixing at temperatures from 60 to 200° F. These grades vary in viscosity from 75-150 Saybolt furol seconds at 77° F. to 300-600 Saybolt furol seconds at 180° F. All RC cut-backs consist of a blend of a selected grade of asphalt cement and a petroleum naphtha fraction (boiling range essentially within 200-425° F.). The various grades may contain from 15% by volume of naphtha in the most viscous grade to 45% by volume in the least viscous grade.

3—Medium curing cut-backs are liquid asphalts made in different consistencies or viscosities to permit convenient spraying or mixing at temperatures from 60 to 200° F. These grades vary in viscosity from 75-150 Saybolt furol seconds at 77° F. to 300-600 Saybolt furol seconds at 180° F. All MC cut-backs consist of a blend of a selected grade of asphalt cement and a petroleum kerosene distillate fraction (boiling range essentially within 300 to 525° F.). The various grades may contain from 15% by volume of kerosene distillates in the most viscous grade to 45% by volume in the least viscous grade.

4—Slow curing road oils are liquid asphalts made generally in the same viscosity consistency grades as RC and MC cut-backs but composed of higher boiling petroleum fractions blended with a residuum stock or an asphalt cement. The straight-run type stocks are generally used although the other types described above are used where specifications permit.

5—Asphalt emulsions are liquid asphalts of low viscosity (generally 20-100 Saybolt furol seconds at 77° F.) consisting of an asphalt cement emulsified with water. Asphalt road emulsions generally contain 55 to 70% by volume of asphalt and are made in rapid, medium, and slow setting types to conform to the requirements of the application.

6—Miscellaneous asphalts include semi-solids and liquid materials of special preparation or specification for use as crack fillers, for undersealing concrete pavements, and for membrane or waterproofing construction with road building. The asphalts within this classification may be straight run, air blown, or blends of either of these with mineral filler, rubber, or volatile diluents.

Industrial Asphalts

1—Blown asphalts (sometimes called oxidized asphalts) are specially processed materials made by passing air through asphalts kept at elevated temperatures. The duration of this processing varies according to the properties desired in the end product. The starting material, or flux, may consist of a straight run low viscosity residuum or blend of residuums, a blend of residuums and a viscous oil distillate, or a blend of any of these with either a precipitated asphalt or an extract fraction. The blown product will have comparatively high softening points, will be less susceptible to temperature changes, and will possess better weathering properties, all depending upon the starting material, the processing technique, and the requirements of the application.

The most common industrial uses of blown asphalts are as follows:

a) Saturant for roofing, flooring and sheathing felts, and other felt compositions
b) Coating for prepared roofing and siding products
c) Coating for pipes and other underground structures
d) Adhesive for builtup roof construction
e) Adhesive for membrane waterproofing
f) Adhesive for paper laminated products
g) Binder for coke and coal briquets
h) Binder for battery box compositions
i) Binder for floor tile and mastic floor compositions
j) Extender for certain rubber compositions
k) Sealer and filler for expansion joint compositions
l) Membrane liner for canals and reservoirs
m) Base ingredient for certain protective coatings

2—Straight run asphalts for industrial applications may vary from 0 to 300 + penetration at 77° F., depending upon the application. By definition, asphalts within this classification may be either solid or semi-solid in consistency. For purposes of this classification a small percentage of precipitated asphalts or extract material may be included in this straight run category.

These asphalts are used in the following industrial applications:

a) Saturant for felts and felt compositions
b) Saturant for fiberboard and insulation compositions
c) Mold release agent for rubber compositions
d) Binder for coal briquets
e) Base for industrial emulsions
f) Base ingredient for certain protective coatings
g) Flux for blown asphalt manufacture

3—Thermal asphalts (sometimes called cracked asphalts or pressure tar residuums) for industrial applications may be made in solid or semi-solid consistency. They are residuum products separated by distillation of thermal cracking units product. These asphalts are used in the following applications:

a) Saturant for insulated siding
b) Impregnator for fiberboard compositions
c) Binder for coal briquets
d) Base ingredient for certain paint compositions

4—Liquid asphalts for industrial applications may consist of a variety of asphalt base stocks (generally straight run or blown) blended with naphthas or other petroleum distillates. These asphalts may be prepared at refining sources and then sold for blending into other product compositions, or they may be used directly for waterproofing or protective coatings.

Meet the Author

L. W. Corbett

L. W. Corbett is an industrial consultant specializing in asphalt technology with Miller-Warden Associates, Swarthmore, Pa. Mr. Corbett holds a Bachelor of Chemistry degree from the University of Minnesota, 1935. He devoted over 14 years to asphalt research and development with Yale Oil Corp. and Husky Oil Co. prior to joining Miller-Warden in 1953. Mr. Corbett, who saw foreign service with the Army during World War II, is the author of numerous technical articles dealing with asphalts.

The system now in use was developed by the U. S. Bureau of Mines for its Mineral Market Reports. These reports are currently the only comprehensive records of asphalt sales available to the public. Although they are published in a form which improves on an older method that had been based on an arbitrary split by consistency, many classification problems are still unresolved.

Division of asphalts into two groups according to ultimate use would solve these problems. Each type would appear in only one of the two major classifications, rather than in several as in the old method.

And the volume of asphalts in the miscellaneous category would be relatively small. These asphalts would fall in one category, paving, where they logically belong. The present system lists a substantial volume of asphalts as unclassified.

Road oils, in a separate category in the Mineral Market Reports, would be listed where they fit best—in the paving group. Also adequately placed would be those asphalts used for undersealing old pavements, sealing and filling joints, and in waterproofing work on roads, streets, and airports and other traffic bearing surfaces.

Perhaps the most needed improvement afforded by the proposed system would be the disposition of the so-called "roofing" asphalts. Roofing asphalt is used for the manufacture of prepared roofing (shingles, roll roofing, roof felts, etc.) and for the construction of built-up roofs. Both air-blown asphalts and asphalt cements are used for these purposes—the air-blown asphalts in greater quantities.

Now, although the refiner will supply fluxes, asphalt cements, or blown asphalt directly to the roofing manufacturer and intermediate compounder (either of whom may convert the flux and some of the asphalt cement to a blown product), the roofing manufacturer may, and generally does, use some of these asphalts in products not connected with roofing.

Therefore, an asphalt refiner does not have complete knowledge of the ultimate use of the products he supplies, and is in no position to report sales in end-use terms. The new classification eliminates this ambiguity and allows the direct reporting of more meaningful figures.

How the system would work

As mentioned above, this system is practical and can be used in any method of record keeping or reporting involving statistics on sales or manufacture of asphalt and its primary products.

This is how a reporting operation might work: an asphalt manufacturer would receive from a soliciting agency, such as the Petroleum and Natural Gas Branch of the Bureau of Mines, a standard form designed for the entering of sales according to the classification described. Included in an accompanying explanatory note would be a detailed specification list of the various categories. This would lessen inaccurate reporting.

The more closely a producer's own record-keeping system resembled the proposed method, the easier his reporting task would be. And the final report in sequence from producer's total to state's total to nation's total, would be entirely logical.

Internal record keeping would follow the proposed method also. Therefore, a company's output and sales could be compared quite easily with figures for states or markets. This direct and accurate comparison would be a significant advantage in the highly competitive field of asphalt manufacture. The resultant figures would also permit trends in product usage to be followed more accurately.

Asphalt Refining is Big Business

ASPHALT products require a good 3% of all the crude oil processed in this country. Even more impressive is the capacity available for its manufacture. Of the nation's total refining capacity of 8-million b/d, more than 400,000 b/d can be used for asphalt production, this is roughly 5%.

Straight run and liquid asphalts, the type used in construction, make up 334,000 b/d of this figure. Capacity for blown asphalts, most of which are used in industrial applications, is about 69,000 b/d. Paving asphalts traditionally account for about 70% of the total of asphalts manufactured.

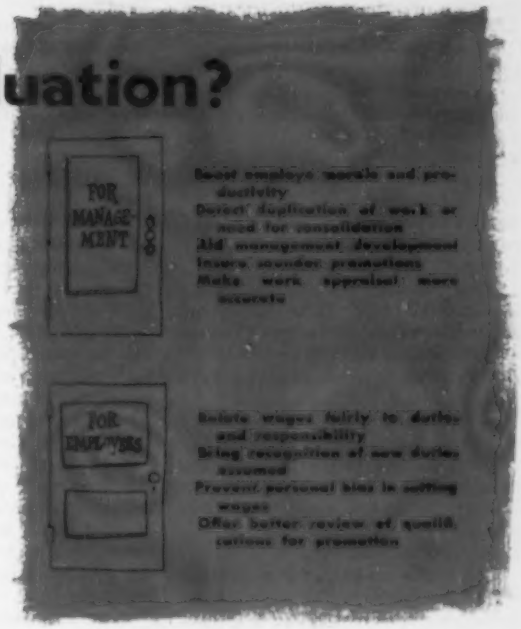
The use of paving asphalts is growing. Except for slow curing road oils, all categories in the paving group have shown consistent increases in use since the war. Growing fastest in use have been the asphalt cements. About 5.5-million tons were produced in 1954. The popularity of hot mixes has been responsible for a large part of the increase in this type of product.

Cut-backs are used in so many different applications that their use is also increasing. In some states cut-backs are used much more extensively than asphalt cements.

Estimated future paving needs indicate that while there is sufficient asphalt manufacturing capacity for the next few years, additional capacity will be needed by 1960.

Why Use Job Evaluation?

It can assist employe relations in ways you may have overlooked


FOR MANAGEMENT
Boost employe morale and productivity
Detect duplication of work or need for consolidation
Aid management development
Insure sounder promotions
Make work appraisal more accurate
FOR EMPLOYEES
Relate wages fairly to duties and responsibility
Bring recognition of new duties assumed
Prevent personal bias in setting wages
Offer better review of qualifications for promotion

JOB evaluation is a useful management tool, particularly for setting wage structures and controlling costs. However, it will also help improve employe morale and productivity—two added benefits which are frequently overlooked.

What is job evaluation? In the broadest sense, it means any decision that places a value on a job. In this sense, it is far from new and goes back to the day when the first person went to work for pay. However, formal job evaluation may be defined as deciding what a job is "worth" solely in relation to the worth of other jobs within the company, and according to a system.

Formal job evaluation therefore can provide:

- **Better morale:** The employe feels he is being treated fairly when his pay is matched carefully with his duties and responsibilities, and related to the pay of his co-workers in a justified way. He feels his job and his qualifications for promotion will be reviewed periodically.
- **Higher productivity:** Work duplication is avoided. Promotions are more carefully planned. Qualified people are not overlooked.

What is a job evaluation system and how does a company set one up?

A common aim of job evaluation systems is to set up a salary differential based on a generally accepted standard. Let's look at the four types of systems.

1—Classification: One of the first types developed. A system of "classes" is set up according to broad characteristics (factors) found in the company's jobs. Then the jobs are placed in their respective classes.

2—Ranking system: All the jobs are arranged according to their relative value to the company. The job is ranked as a unit, and single factors within the job are not weighed against each other.

3—Point system: A scale of points is set up for each job factor common to all the company's jobs and thought important to job performance. The factors in each job are then appraised and assigned a point value. The point total for all factors in a job ranks it among the other jobs.

4—Factor Comparison system: Essentially each job is compared with the others—factor by factor—to determine their relative difficulty and responsibility. The factors, again, are job characteristics (skill, responsibility, working conditions, physical and mental demand) common to all the jobs and important to the job.

To describe how a company sets up an evaluation system let's use Phillips Petroleum Co. as an example. A job evaluation system adopted recently has led to sounder management.

The company has been growing steadily, its old jobs becoming more complex, and new ones being created every so often to handle new functions. This situation, plus experience with salary stabilization regulations during the war, led management to seek a formal job evaluation system.

A committee surveyed the field. It was found that the existing structure corresponded essentially to a Classification system. Obviously any new plan would have to be an improvement. A system was wanted that would do these four things better:

1—Establish a relative value for jobs both within and between departments.

2—Permit comparison of pay rates with similar jobs in other companies.

3—Permit management to recognize significant changes in the duties and responsibilities of a job.

4—Show which job changes constitute promotions and which do not.

In addition, the system would give consideration to the duties and responsibilities of each job rather than to broad classes or types of jobs when setting its relative worth. And the committee wanted a plan that would utilize the pooled judgment of qualified people in a consistent procedure, to insure impartial decisions.

Factor Comparison was the system chosen. The factors considered are requirements of the jobs themselves and shouldn't be confused with the personal characteristics of the people performing them at the time these appraisals are made. Let's review the factors the committee singled out.

1. BASIC NEEDS

An employe must be able to understand written and verbal instructions; be honest; be willing to take a physical examination, be fingerprinted, show proof of age, and must assign patents to the company. These are considered minimum requirements of employment, "more or less" fulfillment being impossible. A single credit is given for

this factor in each of the company jobs.

2. KNOWLEDGE

This is the first of the variable factors and includes:

Education, meaning information and understanding necessary for the job, normally obtained by formal schooling, and

Experience, also meaning information and understanding necessary for the job but normally obtained through past job performance.

3. MENTAL APPLICATION

This measures the difficulty of the "brain work" required by the job and the mental strain and fatigue it causes.

4. PHYSICAL EFFORT

The physical work required by a job.

5. WORKING CONDITIONS

The disagreeable surroundings, physical hazards to the employe, and other conditions unpleasant to the average person but which are part of the job.

6. RESPONSIBILITY

This factor measures the importance to the company of the types of responsibility the jobs require. Six types are distinguished, to permit better job-by-job comparison. They are:

Supervision of other employes.

Contacts as a representative of the company; that is, his dealings with individuals, companies, or agencies outside the company, and with employe groups or departments within the company.

Material items, that is, the job-holder's responsibility for equipment, tools, supplies, raw materials, buildings or land, and decisions affecting their disposition.

Money, records, and information at his disposal.

Personnel, his control of or effect on other employees where no recognized or direct supervisory relationship exists.

Procedures, or how important to the company are the suggestions, recommendations, or interpretations he might make.

With each of these "sub-factors" it's not simply how much control a person has, but how important the control is to the company. For example, a job that gives a person complete authority over maintenance tools will not be worth as much to the company as another job that involves having only partial control over funds for purchase of land or equipment.

It was then necessary to apply the selected factors. "Job analysis" was the first step. A trained analyst studied each job, interviewed the employe, and prepared job descriptions.

These were then reviewed for accuracy by the job-holder and the supervisor. They are one of the most important instruments of formal job evaluation and will be discussed more fully later.

A number of jobs were selected that were felt to be fairly paid in relation to one another. These were the "key" jobs. They were then ranked by each member of the committee, factor by factor. After a further complicated procedure, this selection of key jobs became the job-rating scale for all subsequent evaluation of jobs.

The other jobs in the company were then compared with the jobs on this scale and given an appropriate position. It should be emphasized that in each phase of this work the pooled judgment of the top management committee was used at all times.

This brief sketch of the evaluation process omits many important details, but it serves to give an idea of what setting up a system entails.

What can it do for better management? This is *the* question for people not professionally concerned with the technique itself.

Gains in employe morale are some of the most important, if intangible, benefits of job evaluation. The employe who knows his job has been carefully appraised, and his wage set in relation to other jobs, will feel he's being more fairly treated than if no such system existed. This is true even though there will always be differences of opinion as to what a job should be paid.

Periodic review assures employes that any new duties and greater responsibility they assume will be recognized and may lead to a higher ranked job. The Factor Comparison system requires such review of job functions. Furthermore, the system can be, and is, made to provide for merit increases.

The objectivity is an advantage for the employe, as it means personal bias is eliminated in setting relative rates. His work is neither under nor overrated because of some operation it is part of, or because of the department head's personal opinion.

Productivity of personnel provides benefits not part of morale-building.

Duplication of effort may be spotted this way, or consolidations planned, and both may improve efficiency. But —and this is important—the success of the whole program may be seriously jeopardized unless employes are assured that no individual rate will be lowered as a result of it.

Promotion procedure benefits in important ways. The clear definition of jobs, and the common terminology used for them in all branches of a firm's operations, make it easier to spot qualified candidates for promotions. A man's not apt to be overlooked because he's in a branch location.

Also, promotions or transfers may be planned more intelligently. There have been transfers, in systems not using job evaluation, where employes unknowingly were moved from jobs of higher responsibility to jobs of lower responsibility.

Planning management development is likely to improve for this same reason. Where there are clear definitions of each job, a logical sequence of assignments can be more confidently arranged.

Appraising performance is easier where such a system exists. The job description is the best basis for this because it shows what an employe does. The appraisal is then made in terms of how he does what he does. Using the description, the supervisor can talk objectively to the employe about how he performs the job's stated duties. This is essential even though such personal factors as cooperativeness, loyalty, and others are certainly important and may even be the basis on which the person is promoted, transferred, discharged, etc.

Rating new jobs beforehand is an improvement over the "hindsight" approach. Job evaluation permits early establishment of the job's precise area of responsibility. This helps proper selection of personnel and may even prevent placing the wrong person in a job.

A valuable by-product of this system, not strictly related to morale or productivity, is the information about the company it yields. The descriptions and periodic review of functions furnish management with an excellent means of keeping track of the organization as it expands or is modified.

Experience shows that many supervisors are surprised to read of the duties each employe is performing when the job descriptions are written for the first time. The supervisor will know what his men are doing in general, but often the degree to which they have assumed different functions, traded duties, etc., is not known.

Formal job evaluation, then, clearly offers management a many-sided and effective tool for improving employe relations and the productivity of its working force.

The preceding article has been adapted from a paper: "Job Evaluation—A Management Tool," by C. R. McCullough, director of the service division, refining dept., Phillips Petroleum Co., Bartlesville, Okla., and presented at the regional meeting of the Western Petroleum Refiners Ass'n., Casper, Wyo., Sept. 22, 1955.

Two Case Histories

How to Save Cooling Water

THE conservation of cooling water is a problem of increasing importance in the petroleum processing industries, as refineries, natural gasoline plants and petrochemical facilities continue to move into water-short areas.

Here are two articles telling how operators have met with this problem and solved it—at least in part.

The first deals with a trick Sinclair Oil & Gas Co. has come up with for eliminating the use of cooling water on natural gasoline plant compressor cylinders. The second discusses the use of combination water and air cooling as practiced by Magnolia Petroleum Co. at the Pegasus natural gasoline plant it operates for a joint ownership group near Midland, Texas.

If you are faced with these or similar problems because of a water shortage situation, you will find some helpful information in these two articles.

Save Water

Run Compressor Cylinders without Water

NATURAL gasoline plant compressor cylinders do not have to be water cooled.

After trying this once for three days because of an emergency, Sinclair Oil & Gas Co. found the idea feasible. Two years more of operating experience proved the point. There is apparently no measurable loss in gas-handling capacity and no increase in cylinder wear.

The savings in equipment, installation costs, and maintenance more than justifies the small additional horsepower required to operate without cooling water. As a result, on all new installations the company has discontinued the use of cooling water on gas compressor cylinders.

Historically, the natural gasoline industry has used water cooling on large gas compressor cylinders from the beginning. For years Sinclair Oil accepted this traditional cooling system as necessary for proper operation and spent considerable sums of money installing and maintaining pumps, headers, piping, cooling equipment, chemical treatment, etc. No thought was given to eliminating this expense and effort until 1940.

During that year at one of the larger plants, it became necessary to replace completely the compressor jacket water inlet and outlet headers, due to corrosion. To save the expense of laying temporary lines or shutting the plant down, it was decided to operate the compressor cylinders without jacket water while the old headers were being removed and new ones installed.

The water was shut off for a short test period. No mechanical difficulties appeared in the cylinders, and the volume of gas compressed remained practically constant. As soon as it became apparent that the cylinders would operate without damage, repairs were started. When the job was done—in about three days—water circulation was resumed. The compressors continued to operate satisfactorily and with no apparent loss in efficiency. A few years later the same situation occurred in another plant and the same practice was used with good results.

About three years ago, the company made a study of ways and means of reducing operating and maintenance expense. The trick with the compressors was recalled, and it was decided to run tests again. Jacket water was cut off and drained on one cylinder each of the first, second, and third compression stages at one of the plants. Parts were inspected and carefully measured before operating without water, after 30 days and again after 90 days of operation without water. No measurable wear was found. Tests were then carried out at various other plants, with the same results.

After approximately one year of these tests, the plan was adopted at most of the Sinclair Oil plants, and cooling water was cut out of all compressor cylinders.

The explanation requires a look at the theory of compressor cooling.

Theory of compressor cooling: The removal of the heat of compression from a compressor cylinder is an important factor in its efficiency. If all the heat of compression is removed we have isothermal compression. If none of the heat of compression is removed it is called adiabatic.

In the design of practical compressor cylinders, even though water is circulated in the jackets, only a nominal amount of heat is removed, which satisfies neither of the above definitions. This performance is called polytropic compression. The horsepower requirements of adiabatic and polytropic compression can be compared by setting up a theoretical problem.

Assume that by circulating cooling water, the discharge gas temperature

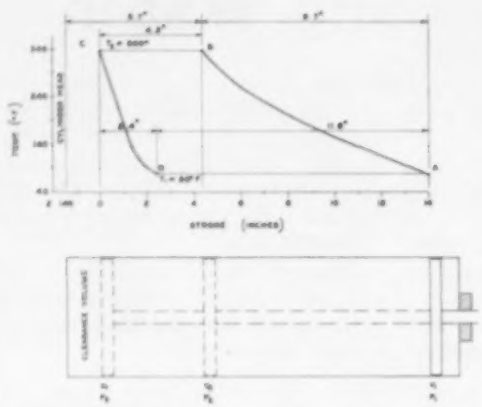


FIG. 1—Temperature differences through a hypothetical cylinder at beginning and end of the stroke

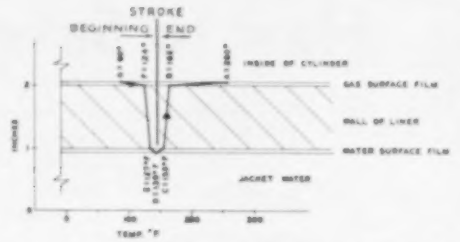


FIG. 2—Type of temperature fluctuation expected in compressor cylinder wall

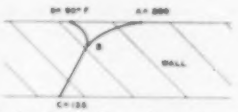


FIG. 3—Relationship of stroke to temperature inside head end of cylinder during one revolution of crankshaft

can be reduced by 20° F. Assume a temperature reduction greater than will likely occur in practice so that the horsepower difference will be as great, or greater, than any actual instance. Also by choosing air as the substance, accepted data can be used, and the horsepower calculated will be a maximum for a given set of conditions. Now, compare the theoretic adiabatic and polytropic horsepower required to compress 1 million cu. ft. of air through four compression ratios.

The adiabatic compression (n=1.4) requires 75.2 hp. and the polytropic compression (n=1.365) requires 74.2 hp. This means that the gross benefit of circulating jacket water could not be more than 1 hp. per million cubic feet of air compressed.

On the other hand, some horsepower must be used to circulate jacket water. If a 500 Btu/hphr. heat rejection from the cylinder is assumed, as recommended by a prominent compressor manufacturer, and a 5-deg. temperature rise in the cooling water, then more than 0.25 hp. will be required for pumping the compressor jacket water.

In connection with the comparison of horsepower required, it should be remembered that operators who use closed system cooling generally use the same pumps for circulating water for cooling both the compressor and the engine. This means that high-temperature water will be pumped to the compressor cylinders. This water will heat the incoming gas and so increase the horsepower required to compress a given weight of gas.

Thus, it is seen that the horsepower required to circulate jacket water and the additional horsepower required to heat the incoming gas have reduced the very small 1-hp. gain from the use of jacket water until the horsepower requirements will be decreased less than 1% by circulating jacket water.

Capacity: The maximum gas-handling capacity of a specific cylinder will be increased approximately 0.25% by not circulating jacket water, because at the higher temperature the clearance volume will contain less weight of gas at the end of the stroke. The actual amount of increase will depend on the amount of clearance volume and the absolute temperature of the gas remaining at the end of the stroke. To prove this, two tests were run, the results of which are shown in the table.

The data are not as extensive as might be desired. However, they do suggest some very interesting studies. It will be noticed that in Test No. 1, the temperature of the compressor discharge is actually higher when circulating jacket water than it is when no water is circulated. A detailed study of heat transfer through the cylinder walls will help explain this phenomenon.

This reversal of expected temperatures occurs only where jacket water temperature is relatively high. Fig. 1 is a schematic picture of temperature differences through a hypothetical cylinder wall at the beginning and at the end of the stroke. Points A-B-C-D represent temperature as heat travels from the gas in the cylinder to the jacket water at the end of the stroke. Points D-E-F-G represent temperatures as heat travels from the jacket water to the gas at the beginning of the stroke.

The temperatures shown on Fig. 1 as the heat flows from the gas to the jacket water are calculated for a flow of 15,300 Btu/hr., or a 20-deg. reduction in discharge temperature of 1,000,000 cu. ft. of air. The heat flow from jacket water to gas was calculated on the basis of temperatures of water and gas shown, and the surface temperatures were calculated from this rate of flow.

It can be seen from Fig. 1 that the jacket water would not have to go much higher before the direction of the heat flow is reversed and more heat would travel from the jacket water to the gas at the beginning of the stroke than is returned from the gas to the jacket water at the end of the stroke.

Calculations indicate that with 150° F. cooling water to the hypothetical cylinder, more heat will be transferred from the water to the gas during the suction stroke than from the gas to the water during the compression and discharge portions of the stroke. The tabulated data show that this actually has occurred. It is also true that as the n-value decreases the temperature at which the reversal of heat flow occurs will be lower. This situation requires some small additional horsepower to compress the gas.

Fig. 1 is treated as if the conditions at the beginning and the end of the

stroke existed separately and were of the nature of steady flow to better emphasize the heat flow in each direction. Actually the outside wall of the cylinder liner remains at some constant temperature while the inside temperature of the liner will fluctuate with the temperature of the gas being compressed.

It has been stated that in the internal combustion engine cylinder wall the temperature fluctuation does not penetrate deeply. The range of fluctuation is only 1° F. at approximately 3/8 in. from the inside surface of the cylinder. Fig. 2 is a schematic picture of this type temperature fluctuation as it is expected to occur in the compressor cylinder wall. This conception of heat transfer helps to strengthen our belief that the conventional compressor cylinder is a very poor heat exchanger.

Quantity of Heat Transfer: Fig. 3 is a schematic drawing showing the relationship of stroke to temperatures inside the head end of a compressor cylinder during one complete revolution of the crankshaft. The frame end diagram is omitted to simplify the drawing.

To prepare the data for Fig. 3, the performance of a 15.1-in. x 14-in. compressor cylinder operating at 300 rpm. with 10% of clearance and a compression ratio of 4 is used. This hypothetical cylinder is used because it will compress 1,000,000 cu. ft. of air from 14.7 psia. to 58.8 psia. The calculated quantity of heat transferred through the walls of this cylinder to 90° F. cooling water will be compared with the amount of heat considered to be removed by the cooling water in an earlier example.

Referring now to Fig. 3, air is compressed along line *AB*. This compression increases the air temperatures from 90 to 355° F. To accomplish this compression, the piston must move through 9.7 in. of its 14-in. forward stroke. This 9.7-in. of piston travel requires 31% of the time for one complete revolution of the crank, and during this time 0.192 Btu is transferred to the cooling water.

The 335° F. air is then discharged along line *BC*. The piston travel is 4.3 in. and requires 19% of the time for one revolution. During the discharge portion of the stroke 0.083 Btu is transferred to the jacket water.

Air remaining in the clearance volume is next expanded from *C* to *D* and the temperature is reduced from 335 to 90° F. Expansion occurs through 2.4 in. of piston travel and requires 15% of the time of one revolution. During expansion 0.022 Btu is transferred to the jacket water.

Effect of "No-Water" Cooling on Critical Variables

Cyl. Size	Stage	Jacket Water Temp °F In	Out	Suction Psig	In. Hg	Temp	Discharge Psig	In. Hg	Temp	ΔT	Comp. Ratios R	Gas Const. n
Test No. 1:												
18x20	1st	135	140	—	11.2	78	36	——	266	188	5.61	1.21
" "	"	none	none	—	11.2	78	36	——	264	186	5.61	1.207
8½x20	2nd	135	140	31	——	110	275	——	298	188	6.36	1.184
" "	"	none	none	31	——	100	270	——	283	183	6.25	1.184
Test No. 2:												
33x20	1st	85	94	—	19	60	——	5	168	108	2.33	1.292
" "	"	none	none	—	18	78	3	——	189	111	2.3	1.288
19x20	2nd	85	94	—	5	147	45	——	282	135	5.0	1.142
" "	"	none	none	—	3	164	49	——	341	177	4.92	1.184
10x20	3rd	85	100	42	——	97	260	——	248	151	4.87	1.178
" "	"	none	none	44	——	99	252	——	267	168	4.56	1.209

Intake occurs from *D* to *A* through 11.6 in. of piston travel, which requires 35% of the time required for one complete revolution of the crank. Since the jacket water and the gas are the same temperature in this example, no heat is transferred during the suction stroke. Thus for one complete revolution it is calculated that 0.279 Btu is transferred through the cylinder walls to the jacket water, from the head end, which is a total of 10,000 Btu/hr. This 10,000 Btu/hr. is a great deal less than the conventional figure of 57,000 Btu/hr. recommended by engine manufacturers and is considerably less than 15,400 Btu/hr. which must be removed by the jacket water if the compressor discharge temperature is to be reduced 20° F.

The point is that time and money have been spent installing cooling equipment that is not necessary for efficient compressor operation.

Practical Application: No complicated procedure is required to prepare a plant for operating without cooling water in the compressor jackets. The cooling water is shut off, the piping removed and the pipe connections covered with screen wire. Filling the water jackets with oil has been tried. No definite advantage has been shown. This procedure has been discontinued because it is troublesome, messy and requires unnecessary time and expense for installation and maintenance.

It seems reasonable to expect that the temperature difference between the cylinder liner and piston will be smaller when no cooling water is present. Sinclair Oil's experience has been that any compressor cylinder operating satisfactorily with jacket water will do an equally good job without jacket water. Compressor cylinders have been operated without cooling water to as high as 6.5 compression ratios without encountering trouble. It cannot be said what the practical upper limit of compression ratio is.

By way of warning, however, it should be pointed out that discharge temperature as high as 550° F. has been considered. This temperature occurred in a station where gas was to be compressed from 26 in. Hg. vacuum to 50 psig. through three stages without intercooling and compressor jacket water cooling. The difficulty anticipated was in the case where a field line became parted and the gas to the compressor suction changed to air. This high percentage of air in the compressor increased the value *n* and, as a result of the increase in *n*-value, the discharge temperature of the gas was increased until it was alarmingly near the combustion temperature of the lube oil and heavy components in the gas. To avoid this high temperature an intercooler was installed between second and third stages, thus reducing the danger of explosion.

Sinclair has found the operation of compressor cylinders without jacket water to be very helpful, especially in those cases where the engine jackets are cooled by ebullition (boiling). The 212° F. or higher water being circulated for the engine jacket is out of the question as a coolant for compressor cylinders. The conventional practice is to install an extra cooling coil to supply colder water for the compressor cylinders. The simplification of the cooling system by omitting the extra cooling coil pump and piping is especially attractive in these cases.

(*Turn page for second article*)

The preceding article has been based on the paper, "The Operation of Compressor Cylinders without Cooling Water," by J. L. Gallagher, general superintendent, and H. W. Evans, senior engineer, Sinclair Oil & Gas Co., Tulsa, Okla., at the ASME Petroleum Mechanical Engrg. Conference in New Orleans, La., Sept. 25-28, 1955.

Saving Water

Use Combination Air-Water Cooling

USE of process cooling water at the Pegasus natural gasoline plant operated by Magnolia Petroleum Co. near Midland, Texas, has been cut to almost one-tenth of theoretical peak load requirements.

This was accomplished by using a combination of air and water cooling. Although a relatively simple example and by no means unique, Magnolia's method illustrates today's thinking in combination air-water cooling.

In the two summers and one winter since the plant went onstream, the experience has been this:

- Design peak cooling load of 150,220,000 Btu has been split, as shown in the table, approximately 85% being handled by air and 15% by water.
- This peak load would have required a theoretical 301 gpm. of water. With a cooling tower, the overall total would have been 376 gpm., adding 25% to compensate for blowdown and windage losses.
- Actual total water requirements at Pegasus for all services, including cooling, has been 17,000,000 gal./yr., an average of 32.24 gpm.
- To meet actual cooling water requirements, Magnolia had to drill just five water wells, each good for 10 to 30 gpm. The theoretical water needs, under peak conditions, would have required 20 to 40 such wells. These would have had to be scattered over a wide area and would have required replenishing by local rainfall.

Pegasus processes 60,000 mcfd. of natural gas. Designed recovery during the summer is 96,000 gal./day of natural gasoline and 118,000 gal./day of butanes and propane. Propane recovery actually is variable: more is made in winter than in summer.

Three-stage gas compression and two stages of flashing and reabsorption are used. The plant is equipped with provisions for sweetening products and drying the residue gas. Distillation columns include a deethanizer, depropanizer, and debutanizer in addition to a rich oil still. Steam and electric power are plant-generated.

Little or no industrial water is available commercially in the area. Water comes from wells which tap a trapped water sand not significantly replenished by the small annual rainfall. Water wells cost about $5000 each and produce at an approximate rate of only 10 to 30 gpm. maximum. Unless blowdown rates are kept high, chemical treatment is needed before this water can be used in boilers and cooling towers. The plant wells must supply all boiler, cooling, sanitary, and potable water requirements.

Here's what was done. The first moves were to see how much of the plant cooling load could be shifted to direct air cooling alone, what services would need both air and water cooling, and which requirements could be met only with all-water cooling. The final groupings are shown in the table.

The decision to split the cooling load between air and water was based on design conditions of 98° F. air having a wet bulb temperature of 75° F. Cooling water specified was: "hot side," 95° F.; "cold side," 80° F.; easily attained conditions in a dry climate.

The generally accepted limit for air-cooling is a 20° approach. In other words, the cold fluid leaving the unit is 20° F. higher than the "fresh" air temperature. At the penalty of more heat transfer area, the approach can be reduced to 15°. The practical limit for extreme cases is a rare 10°, after which the cost of heat transfer surface for direct air-cooling becomes quite astronomical and operating costs also climb out of reason.

The obvious first choice for direct air-cooling was engine jacket-water and lubricating oil. It is rarely desirable to have jacket-water enter the engine at a temperature below 130° F., oil at approximately 150° F., and thus one of the largest single heating loads in the plant, 57 million Btu, could be disposed of. Six individual units were required.

The next big heating load to attract engineering attention was removal of interstage heat of compression from the wet gas. It was desirable in terms of investment in compressors to have suction gas at about 100° F., impractical to attain with air-cooling alone. However, a 17° approach to design air temperature is feasible and the interstage and final gas could be brought down to 115° F. in this manner, removing 27 million Btu. The remaining 11 million Btu is removed

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FAILING water supply is a growing problem in refineries, petrochemical, and natural gasoline plants. In some areas the rapidly dropping water table is forcing industry to supply itself from distance sources or to substitute brackish water for its usual supply. But these are drastic measures, resorted to when conservation proves inadequate.

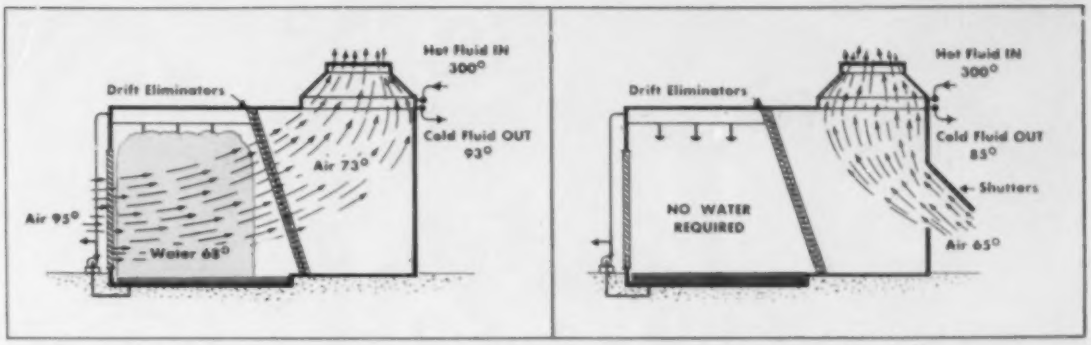
Among the plant operations lending themselves to conservation techniques, process cooling can provide excellent results. One of the largest water consumers, process cooling requirements in even a small natural gasoline plant can total several hundred gallons per minute. Desert-type plants have proved that cooling water needs can be greatly reduced. This article describes such an operation.

There are only three practical methods of industrial cooling: (1) water, (2) air, and (3) a combination of water and air. Combination cooling can cut water requirements sufficiently to make this method an alternative to expensive changes in source of supply.

The use of air for cooling does not necessarily increase fire hazard. Also, air cooling is not always at least as expensive in first cost as water cooling. And, when operating and maintenance costs are considered, air cooling can be less expensive.

This can be illustrated by examining the cooling of a stream from 500 or 600° F. to 120° F. With water cooling only, tube scaling would have to be expected unless the water were very carefully treated and the equipment designed for high thermal stresses and guarded against thermal shock. Air cooling eliminates both scaling and thermal shock.

In any situation where available water is brackish or scale-forming, combination cooling can be competitive because of the maintenance and treatment costs of straight water cooling. The ratio of air to water cooling in a combination system depends on process requirements.



HOW COMBINATION AIR-WATER COOLING WORKS: both being used in summer (left) and air only in winter (right)

by water in shell-and-tube exchangers located near the compressors.

Both oily and clean steam had to be condensed in order to conserve boiler water make-up, even though the oily steam requires purification before re-use. Steam condensation is readily accomplished with direct air cooling. The units are much smaller than the gas coolers since the total load in this service is but 7.17 million Btu.

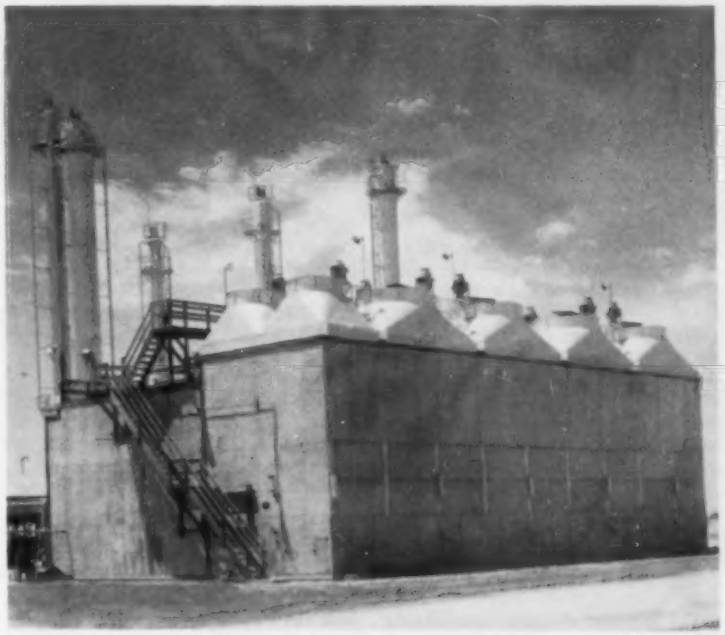
Debutanizer and depropanizer overhead streams also can be totally condensed at 125° F. under the pressures used. This temperature is sufficiently low to meet reflux requirements. Together these two heating loads represent the removal of 16.6 million Btu.

All told, by direct air-cooling, the plant water requirement could thus be reduced by 71.74% from the original 301 gpm. theoretical, or to approximately 85 gpm.

But even this could mean six to ten wells to satisfy peak summer requirements, unless a smaller number of wells were produced at a maximum rate the year-round and the excess produced during cool weather stored in a man-made reservoir (where it would be subject to evaporation losses in summer-time).

It should be emphasized at this point that the figure of 106 actual gpm. (including losses) is only the peak requirement. At all other times, when the air temperature is lower, a proportionately greater amount of heat will be removed by direct air-cooling. Also, a cooling tower then will exhibit less than peak water make-up requirement, since the effluent water will be colder. More of the cooling of the water will occur from merely increasing the sensible heat in the air passing through the tower and less by water evaporation, the latter determining make-up.

The air coolers after cooling the raw gas are able to handle the entire aftercooling load without subsequent cooling by water during cold winter days. Equipment must be sized for peak loads, however.



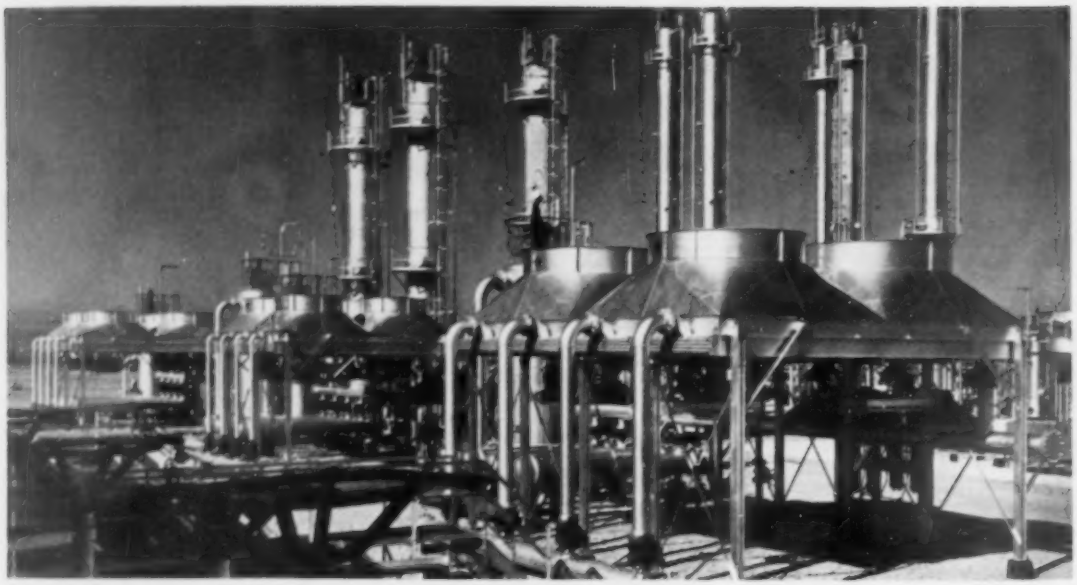
THE COMBINATION COOLING UNIT shown in the drawing, as installed at the Pegasus gasoline plant

Here was the apparent practical limit for employing direct air-cooling. The remaining services all required temperatures of 100° F. and below; even the first involving an impractical 2° approach to the summer air temperature. But Magnolia's engineers decided to make use of a comparatively recent development* in cooling equipment which takes advantage of the cool, though very humid, air leaving the top of a cooling tower.

This new type of cooling unit in essence is the combination of a conventional induced-draft cooling tower with extended heat transfer sections such as used in a direct air-cooling unit. The fans which produce the induced draft also suck the wet air from the tower over these "dry" heat exchange surfaces. In practice, however, it is not quite that simple. A schematic diagram of the unit is shown.

The combination air-cooled heat exchanger and water-cooling tower is built much like an induced draft cooling tower except that fans are located

* The "Combin-Aire" unit developed to cool simultaneously with air and water by Hudson Engineering Corp., Houston. Most of the direct air-cooling equipment in the plant also was furnished by Hudson, the so-called "Solo-Aire" units.



AIR-COOLED HEAT EXCHANGERS on three-stage wet gas cooling. Supplementary water-cooled exchangers are alongside

over a plenum chamber adjacent to the cooling tower proper. Air-cooled heat transfer bundles are located beneath the fans. Louvers on the cooling-tower side extend almost to the top of one major side wall. There are no fans on top of this section, just sufficient space being allowed for proper water distribution. Like any cooling tower, this section is completely packed in the usual manner.

The side opposite the inlet louvers is solely a drift eliminator (baffle). This arrangement gives the cooling air a cross-flow movement rather than a 90° turn as in the usual induced-draft tower.

The plenum chamber immediately adjacent to the mist eliminators serves three purposes:

1—It allows any mist which escapes the eliminators to drop out of the air-stream at this point; in a way, it is a separator, returning drift to the tower basin.

2—It serves as a chamber for admission of direct air to the fans, permitting effective short-circuiting of the water-cooling portion of this combination tower.

3—It distributes air evenly over the heat transfer surfaces.

The outward wall of the plenum has hinged shutters. These may be opened to admit air directly to the fans. Some units are air cylinder shutter-actuated under the control of temperature controllers. These may be set to keep cold water temperature constant automatically or to open the shutters when ambient air temperature falls below a set point. Alternatively, the shutters may be manually controlled. The air-cooled sections always get all the air needed to perform their function.

Such a tower is relatively immune to freeze-ups in cold weather and is very flexible in operation. The motors have two speeds and fan blades have adjustable pitch for additional control. The arrangement, moreover, has the advantage of supplying air for direct air-cooling at a lower temperature (because of evaporative cooling) than that of the air entering the tower, especially in summer when cooling requirements are at their peak.

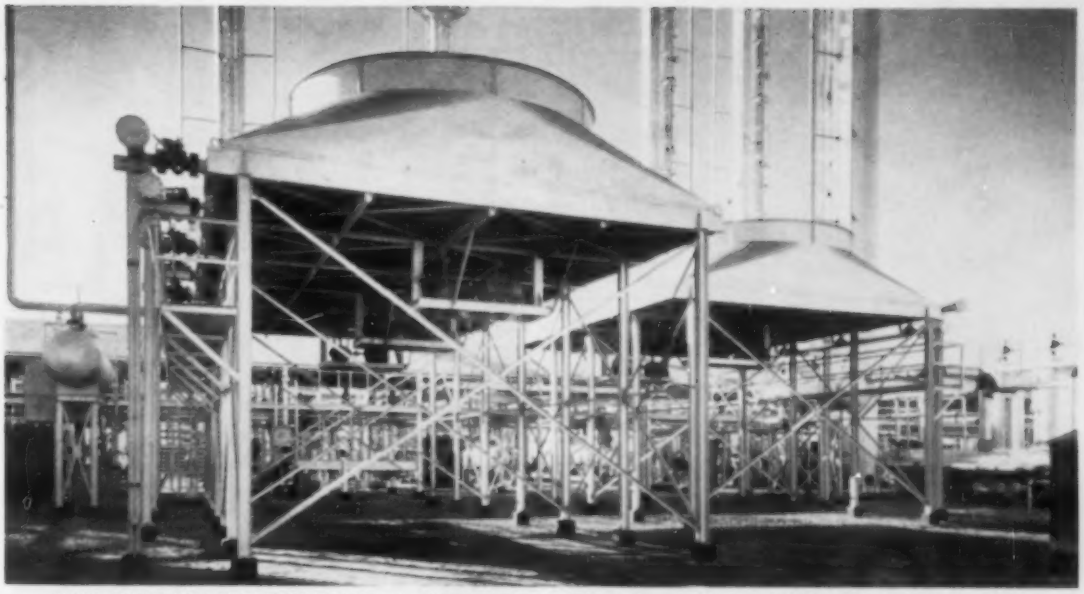
Magnolia's engineers chose to have all water cooling occur in shell-and-tube exchangers, even though certain process streams actually are led to the air-cooled exchanger bundles in this item of equipment. An alternate design, of course, would have been to build the unit with two basins and install atmospheric sections over one of them. Another alternate would have been to cool all streams requiring water using atmospheric sections in the cooling tower portion of the unit.

This is again illustrated by the unit at the Pegasus plant. Design air to the cooling tower portion enters at 98° F. but leaves at 85° F., saturated. This is 13° cooler than could be attained otherwise. The air-cooled bundles underneath the fans have an effluent temperature of 100°, representing a 15° approach to entering air. Note that as a result of this combination, the air-cooled unit effluent in effect approaches within 2° of the design air temperature, an ordinarily impractical feat, and fully benefitted by evaporative cooling. There is little chance of air recycling in an induced draft unit.

Magnolia thus was able to dissipate another 18.7 million Btu by direct air-cooling, which in terms of water consumption represents 37.4 gpm. more at peak summer load conditions (46.8 gpm. if losses are included) by the use of the special combination tower.

All told, the peak load water requirement of this plant was reduced 328.9 gpm. by judicious combinations of direct air and air-and-water cooling. Design maximum water requirement is 47.5 gpm. (59.4 including losses) and in practice will not go this high because high design air temperatures occur for only a part of each day, even during summer months. In cool weather, or in winter, it was estimated before the plant was built that the make-up water requirement due to evaporative cooling would approximate 9.7 gpm. and that the year-'round average would be about 24 gpm.

Magnolia's engineers came up with a final trick to further cut make-up requirements of water after consultation with water treating specialists. By careful attention to details, it was decided that the Pegasus plant could permit the cooling water to concentrate 15 times, compared to the usual



MORE AIR-COOLED HEAT TRANSFER UNITS. These are in service on depropanizer and debutanizer overhead vapors

six or seven.** The increased cost due to heavier treating is less expensive than drilling more water wells.

This is nearly the ultimate in water conservation. Theoretically, a bit more could have been saved by using hot oil for process heating instead of steam, as some natural gasoline plants have successfully demonstrated. However, in the Magnolia plant there were various process reasons why steam was more desirable than hot oil; among them, cost of heaters, greater fire hazard, and some provisions which also would cost extra money to supply stripping medium to the still.

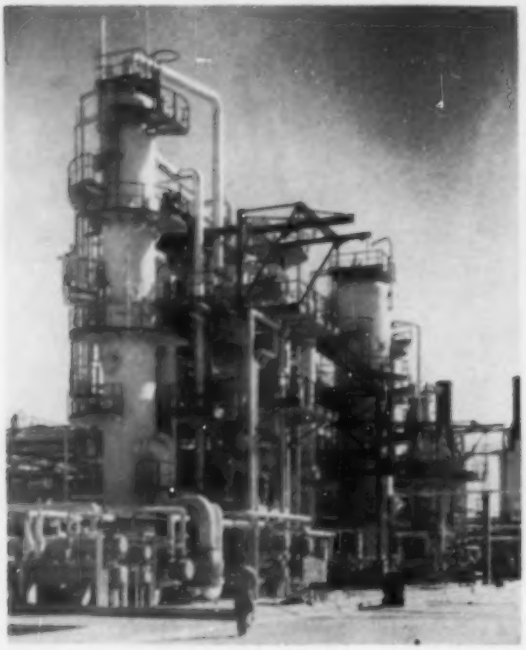
Refineries and chemical plants have the same opportunities to conserve water by combination cooling with both air and water, rather than with water alone. In fact, a better case often can be made for the refinery than a natural gasoline plant, because there are so many streams which now are cooled with water that need not be brought down this way.

Air would suffice even if the final temperature was up around 125° F. Many refineries and chemical plants now considering the feasibility of using brackish water, or securing more fresh water by piping it considerable distances, may find it less expensive to let air take over the roughest part of the job. Existing cooling water thus may be reserved to supply the final increment of cooling to meet process requirements where really necessary. A lot of plant streams do not *have* to be cooled to 75° or 80° F. And, it may be good community relations to help conserve water.

** The number of "times" solids originally present in fresh water are concentrated by evaporation. If calcium was originally present at 10 ppm., for example, blowdown will be regulated so that calcium will not exceed 150 ppm. Treating agents also will be employed so calcium will not deposit out from solution at this concentration.

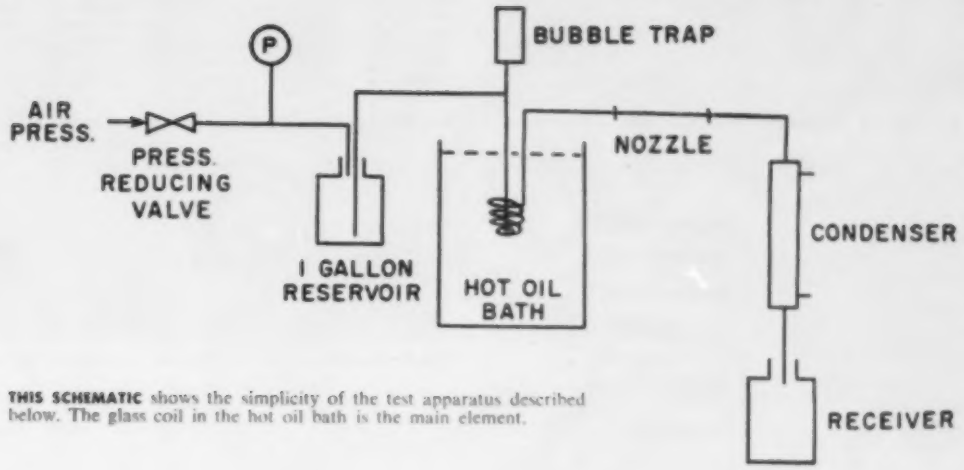
Cooling Load Distribution Between Air and Water At Pegasus

Process Service	Design Cooling Load, MBtu	
	Direct Air	Water
Direct Air Cooling Only:		
Jacket Water & Lube Oil Coolers (6 units)	57,000	—
1st, 2nd, and 3rd Stage Raw Gas Coolers	27,000	—
"Oily" Steam Condenser	3,170	—
"Clean" Steam Condenser	4,000	—
Depropanizer Overhead Condenser	9,850	—
Debutanizer Overhead Condenser	6,750	—
(Sub-Totals)	(107,770)	—
Combined Air & Water Cooling:		
Still Overhead Condenser	15,100	4,300
Lean Oil Cooler	2,150	700
De-ethanizer Overhead Condenser	1,450	700
(Sub-Totals)	(18,700)	(5,700)
Water Cooling Only:		
Propane Product Cooler	—	350
Depropanizer Bottoms Cooler	—	500
Butane Product Cooler	—	250
Gasoline Product Cooler	—	350
Amine Cooler	—	1,400
Glyco Cooler	—	250
Propane Regeneration Gas Cooler	—	450
Main Absorber Residue Gas Cooler	—	900
Main Absorber Base Cooler	—	2,600
1st Stage Wet Gas Aftercooler	—	2,800
2nd Stage Wet Gas Aftercooler	—	3,700
3rd Stage Wet Gas Aftercooler	—	4,500
Totals Water and Air Cooling	126,470	23,750
Total All Cooling	150,220	



WESTERN CANADA'S NEWEST lube oil plant, Imperial Oil Ltd.'s $13,000,000 installation at Edmonton, Alta., dedicated Nov. 2, with a capacity of about 1900 b/d, will make 41 different types of oil for marketing in the prairie provinces, British Columbia, and the northwest. Hydrofining will be used in the processing: this is the first full-scale application of by-product hydrogen from catalytic reforming for this purpose in North America.

BACK TO SCHOOL—Three oil executives of a total of 31 who this fall attended Pittsburgh University's 15th session of "Management Problems for Executives," a 10-week intensive course of study, on the Pitt campus and in visits to industry in the area. Here J. V. Short, Socony Mobil Oil Co., New York; Henri Mayslich, Esso Standard S.A.F., Paris, and E. R. Neath, Humble Pipe Line Co., Longview, Tex., hear guide Adam Vayda, of Gulf Oil Corp., explain the workings of a test engine in Gulf's Harmarville, Pa., research laboratories.



THIS SCHEMATIC shows the simplicity of the test apparatus described below. The glass coil in the hot oil bath is the main element.

Here's a Practical Test for

Jet Fuel Thermal Stability

The stability of jet fuels, especially under heat, is a big problem which may become bigger if present plans to use a jet's fuel supply as a heat sink for the temperatures of high speed flight are successful. In such a cooling system, heat forms sludge and insoluble residues in the fuel supply. These contaminants clog fuel filters and burner nozzles.

Considerable research is underway to prevent this jet fuel deterioration. Until recently this work was hampered by the inefficient stability testing equipment available. Most of these tests were static and involved high temperature bombs. However, the Erdco Jet Fuel Coker, a unit similar to the one described briefly at the end of this article, has been selected as a standard test apparatus. It is a high pressure unit which provides good results. The test described in this article is a low pressure method yielding results correlating with those of full scale rigs.

By

C. M. BARRINGER,

M. W. CORZILIUS,

and J. D. ROGERS

E. I. du Pont de Nemours & Co., Inc., Wilmington, Del.

C.M. Barringer

Dr. Barringer, who was born in N. Y. City in 1920, has a B.A., M.A., and Ph.D. from Princeton. He is now located in du Pont's Rubber Lab, after serving hitches in both the Jackson, and the Petroleum Labs. Mr. Barringer has three children.

M.W. Corzilius

Max Corzilius is now employed in du Pont's Petroleum Labs. The 31 year old Army veteran holds a B.S. from Grove City College, and a M.S. in Chemical Engineering from the University of Delaware. Mr. Corzilius has two children.

J.D. Rogers

John Rogers specialized in rocket and jet fuels for Standard of Calif. before coming to du Pont's Petroleum Chemicals Div. Mr. Rogers holds a B.S. from the University of Delaware and an M.S. in Mechanical Engineering from Stevens.

IMMERSED in the oil bath, in the above schematic of our test unit, is the heart of the system: a coil of 7 ft. 4 mm Pyrex tubing. Deposit formed on this coil after immersion in a 400° F oil bath for controlled periods indicates thermal stability of the tested fuel. The test, which provides best results with low volatility fuels, consumes one gallon of fuel and takes 3 to 4 hours.

The fuel moves through the glass coil under a head of 2½ psi air feed pressure. It is kept moving at a constant rate by a capillary nozzle at the coil exit. Hot fuel is cooled by a water cooled condenser and then collected for examination. A trap is located in the supply line to collect dissolved air and volatiles produced by the heated fuel.

Fuel stability is measured by visually examining the deposit of varnish and coke on the sections of the coil after the heated fuel has passed through. Nine sections are available for the rating system—the inlet tube, the outlet tube, and each of the seven turns. A rating of 0 is assigned to a

Fig. 1—Increased temperature means increased deposit

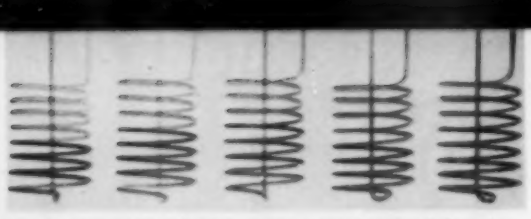


Fig. 2—Increased air feed pressure means increased deposit

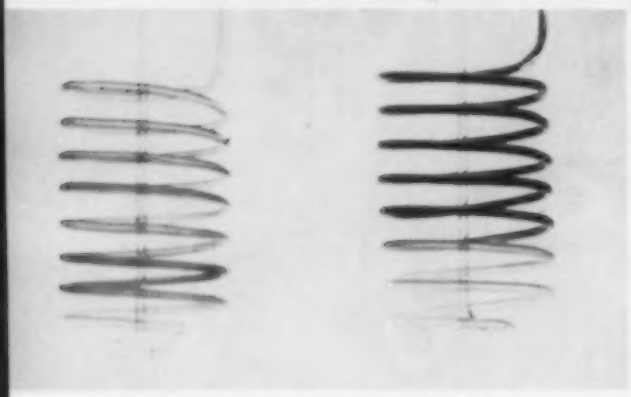


Fig. 3—Longer aging means increased deposit

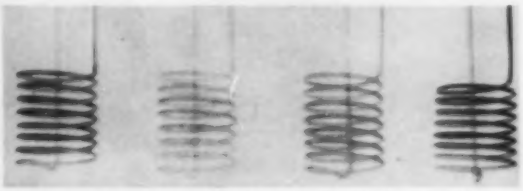


Fig. 4—Dispersants can be effective in reducing deposit

FIG. 5—Additives can reduce fuel storage stability

How the deposits change under variable conditions and additive treatment

completely clean section, and a rating of 5 to a completely opaque section. Therefore, the coil ratings range from 0 to 45.

Agreement of Test Methods

Figure 6 shows a correlation between our glass coil system and a full scale rig operated by one engine manufacturer. Except for one point in the upper right of the graph, the correlation is fair. The deviate point came from a test on a fuel which gave clean results in the full scale rig but dirty results in the glass coil unit.

Results of the two test units were in better agreement when the tested fuels were less than 85% evaporated at 400° F. Applicability of this test, then, might be restricted by fuel volatility.

Varying the Constants

We found that increasing any of the constants-, the temperature of the oil bath, the amount of fuel flow, the air feed pressure, or the length of immersion time, increased the deposits.

Figure 1 shows the effects of varying the temperature of the oil bath between 350 and 425° F. But, again, the big increase in deposit above 400° F may be caused more by evaporation than by decomposition, illustrating the importance of volatility in this test method.

Figures 7 and 8 show the effects of increasing fuel flow and residence time. The increase in deposit is clear.

Increasing the air feed pressure also increases the deposits. This is so even though more air pressure reduces residence time. Increased oxidation may be the cause, resulting from the greater amount of oxygen in the fuel.

Aging by storage at ambient or slightly higher temperature is another cause of thermal instability of fuels. Figure 3 shows the performance of a JP-4 fuel—tested both fresh and after 6 weeks storage at 110° F in the presence of air. Storage increased the deposits formed at high temperatures by more than 50%.

The Deposits

The deposits formed by the fuel are polymeric and only slightly soluble in all common solvents. Deposits from both our unit and the full scale rig have a high percentage of sulfur, nitrogen, and oxygen. As shown in Table 1, the composition of these jet fuel deposits is similar to the insoluble residues of aged No. 2 fuel oils. Studies with this type of oil have shown that oxidized nitrogen and sulfur compounds can polymerize to form insoluble residues.

It is likely that the same reactions, accelerated by higher temperatures, occur in jet fuels.

The residues present in fuels before

Table I—Deposit Analysis

(% Present in:)

Element	Glass Coil Deposit	Full Scale Rig Nozzle Screen Deposits	Insoluble Residue From #2 Heating Oil
Carbon	67	50	50-85
Hydrogen	6	4.7	5-9.5
Sulfur	4	6	1.3-4.7
Nitrogen	2.5	2.3	0.5-5.9
Oxygen	—	—	6-27
Ash	7	mostly Fe_2O_3	6-20

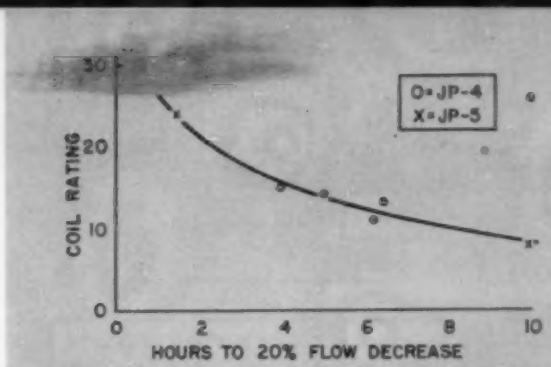


Fig. 6—Except for point in upper right, test correlates well with full scale rig

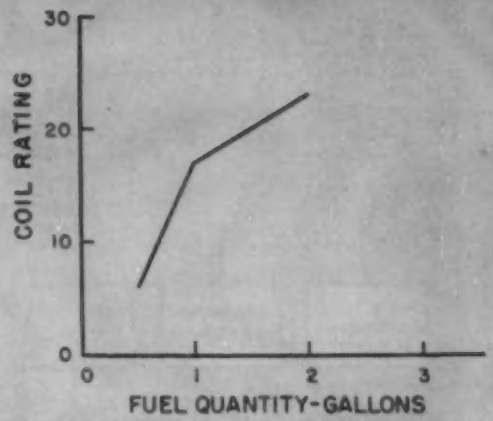


Fig. 7—Increasing fuel quantity passing through coil increases deposit

How the test compares . . . And the effects of fuel quantity and residence time

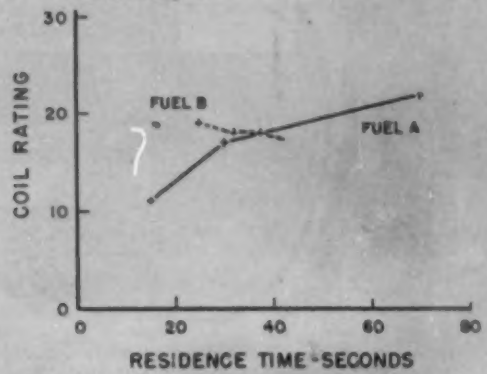


Fig. 8—Longer fuel immersion means more deposit

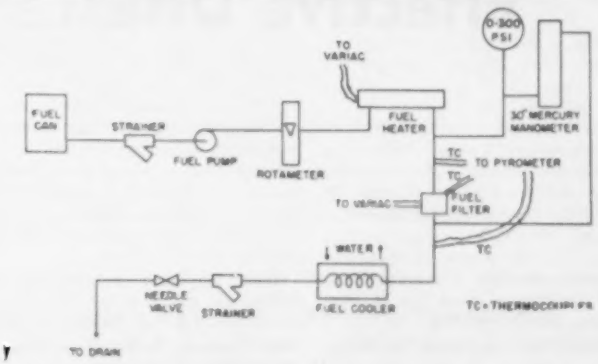
and after passing through the glass coil were centrifuged onto colloidion for electron micrographs. No correlation between appearance and amount of soluble or insoluble residue could be found, although the deposits caused by heating seemed to form larger groups.

Effect of Additives

The type of deposits indicated that dispersants or inhibitors might reduce deposition. Figure 4 shows the response of a JP-4 fuel to additives. The coil from a control run is shown on the left and coils from tests of three additives are shown on the right. The fuel's response to these additives varies widely.

Some additives have improved the high-temperature stability of fuels after storage. As shown in Figure 5 a fuel aged 6 weeks at 110 F without additive has deteriorated while the same fuel with additive remains unchanged.

This article is based on material originally presented by the authors as a paper at the Wright Air Development Center Industrial Conference on Jet Fuels, Dayton, Ohio, Sept. 27, 1954

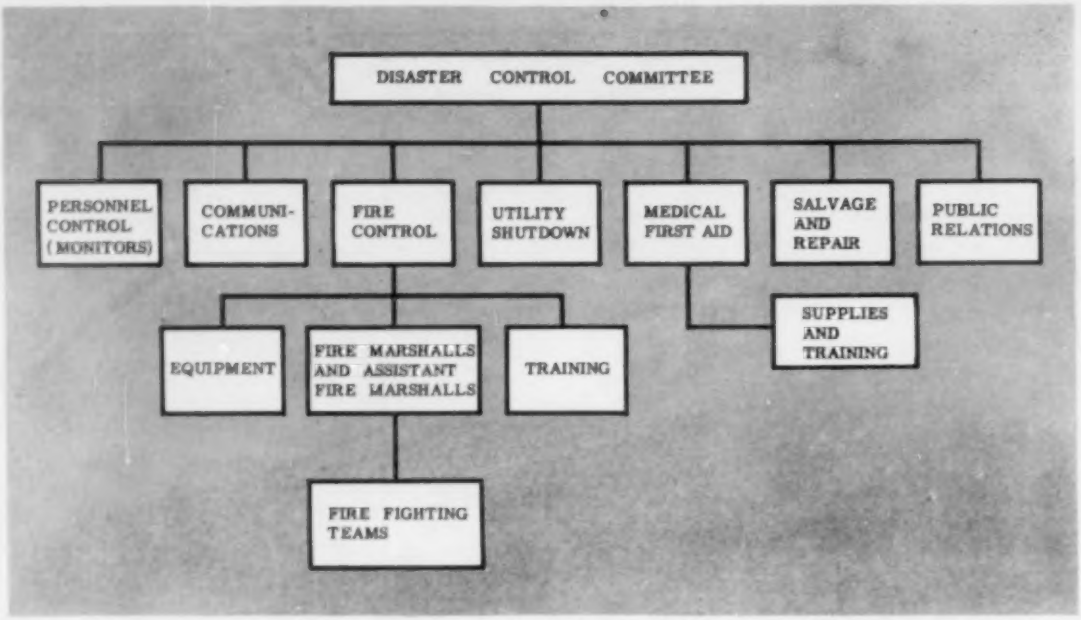


THIS high pressure thermal stability test unit provides good results.

The Erdco High Pressure Test Unit

This unit simulates the conditions in a full scale system but uses small quantities of fuel. It has been used for control and test purposes, and provides good results.

The fuel is heated while passing around an electrically heated aluminum tube. A dynamic measure of fuel stability is obtained by measuring the change in pressure drop across a heated, porous stainless steel filter through which the hot fuel flows while under sufficient pressure to restrain local boiling.



DISASTER CONTROL ORGANIZATION as set up at Esso Research and Engineering Co.

How to Reorganize for

Effective Disaster Control

WHEN the disaster control plan at Esso Research and Engineering was reorganized after the Korean conflict, the needs were examined in terms of the existing conditions and it was found that:

1—A 350-man organization could do a more effective job under the changed conditions than the 1,000-man group then mobilized.

2—Better training would be necessary.

3—The organization should be quickly expandable.

4—The plan should be administered by a Disaster Control Committee.

5—The team system of organization should be used.

Reorganization was then accomplished with these needs in mind.

The purpose of the plan is to strengthen and supplement the facilities available from municipal and state agencies for protection against fires, explosions, and natural causes such as floods and tornados.

The training program emphasizes control of such disasters, and it is recognized that if a major disaster occurred the established agencies would find it difficult to provide the proper assistance to all industries in the community.

Esso Research participates in a mutual aid group in the Linden, N. J., area—the Linden Industrial Mutual Aid Council (LIMAC)—along with seven other firms. If the size of a disaster should warrant it, the facilities of the participating companies would be utilized.

The complete procedures for disaster control are now being spelled out in a Disaster Control Manual. At present this manual includes detailed instructions for operating procedures. It will eventually include sections on all phases of disaster control planning and organization.

The accompanying chart shows the structure of the organization. The basic unit of the setup is a 14-man team of six fire fighters, three first-aid men, and five monitors. These units can provide both effectiveness and on-the-spot action, which often mean the difference between a minor emergency and a major disaster.

Morale of the program's volunteer personnel is excellent. Their interest in the problems of plant safety is responsible for much of the program's progress.

Fire fighting: First consideration of most teams is fire—a primary danger wherever petroleum fractions are handled. Fire fighting training is vigorous. It includes the handling of actual fires. Employe volunteers have been taught the use of carbon dioxide, fog nozzles, foam, dry chemical, and other fire extinguishing methods. They report that fighting fires has given them confidence in their equipment and fire fighting ability. Retraining and periodic drills to improve and maintain effectiveness are important parts of the program.

Key men in the organization, such as the night superintendents and shift foremen who are responsible for fire control during the off-hours, have been trained in fire fighting.

As a disaster control measure, important consideration has been given to the control of utilities. Representatives in all of our 10 divisions have been made responsible for utility control. Charts are to be distributed showing the location of control points in all principal buildings. Quick control of air, gas, steam, and electricity are extremely important for personnel and fire safety.

All laboratory personnel are trained in light fire fighting. If a small lab fire should become dangerous, its handling would become the responsibility of the Fire Control organization. This group, which is headed by Fire Marshalls and Assistant Fire Marshalls, is trained to respond to the emergency alarm that designates location by area code. (Some of the research center's facilities are located at the adjoining Bayway refinery.) The public address system is used as a major channel of communication in directing procedures and summoning additional assistance.

Medical aid: In a major disaster, regular medical personnel would have to be assisted by trained first-aid men. Each team includes three first-aiders, affording the advantage of on-the-spot treatment during an emergency. In the older program emphasis had been placed on first-aid squads and casualty stations.

Of the plan's 350 people, 160 have been trained in first aid; most of these will receive Red Cross certification. Some of the fire fighters and monitors have also received this training in order to increase the organization's effectiveness. Refresher courses are a regular part of the program. In addition, first aid medical supplies have been strategically located throughout the company.

Monitors are responsible for the control of all 2,500 employes. They have been trained to evacuate personnel from buildings, control personnel at the scene of a disaster, and to locate personnel in the best shelter available during air raid alerts.

Efficient communication is essential to proper coordination of disaster control work. Responsibility was assigned for this basic function to the Disaster Control Committee itself. Existing alarm systems and telephone and public address systems have been utilized wherever possible. Additional equipment considered necessary by the Committee is planned.

Other measures: The plan is being expanded to include measures for the reconstruction of damaged facilities. The reconstruction plan emphasizes the assessment of damage, acquisition of materials and equipment, and the organization of construction and mechanical forces for restoration work. A rapid return to normal operations would greatly reduce the total cost of a disaster.

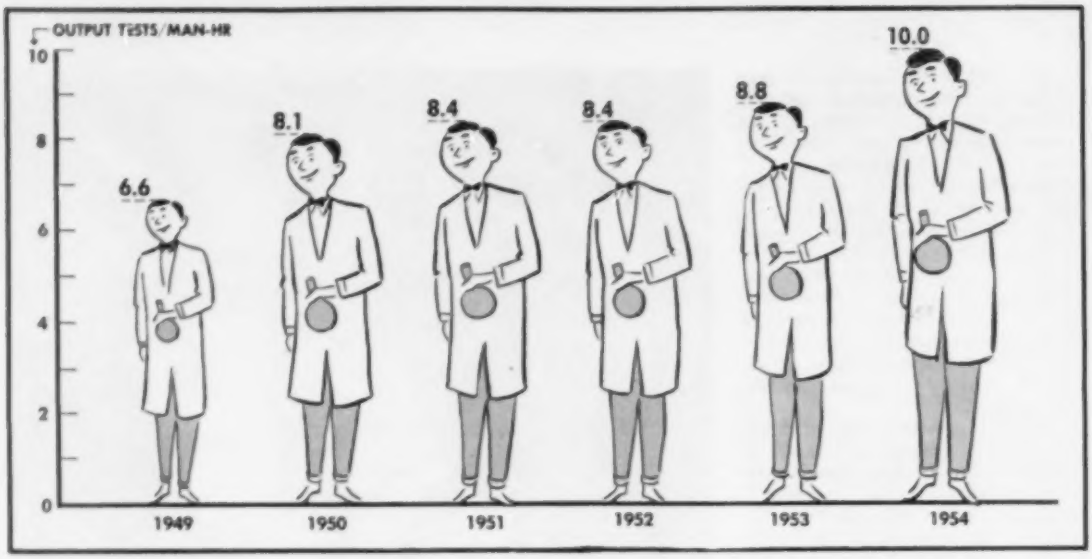
A KEY TRAINING FACTOR in effective disaster control is fire-fighting skill

The plan also includes provisions for the handling of public relations during a disaster.

The goals of the program are to provide the best possible control of peacetime disasters and to maintain a well-trained nucleus for rapid expansion in a national emergency. It is well on the way toward achievement of these aims.

Include These Steps in a Disaster Control Plan

- **Plan by plant areas**—Different parts of a plant are likely to have needs that differ widely.
- **Check on services and equipment** that might have to be provided, including types and quantities.
- **Assign training responsibilities** and spell them out. Your program should develop on schedule.
- **Include interested personnel** in your program wherever possible. Safety-conscious employes do the best job.
- **Set up regular practice** for trial runs and refresher sessions. Your goal is quick, expert action in emergencies.
- **Hold regular reviews** as a built-in feature of your program. Committees should meet on a definite schedule.



INCREASED LAB EFFICIENCY is evident during the six years Tidewater Associated Oil Co. used this system at Bayonne

Could You Use . . .

A 50% Increase in Productivity

. . . in routine control laboratory operation?

By DAVID ROTHBARD

HERE's a workable method for measuring control laboratory efficiency, used to advantage for six years by Tidewater Associated Oil Co. at its Bayonne refinery laboratories (see chart above).

Measuring the efficiency of workers on a production line is not new. In fact, it is now standard in most manufacturing industries. But how to gauge the output of laboratory workers has long seemed difficult—if not impossible. Tidewater has set up a workable efficiency-rating system.

Resulting benefits included:

- All personnel could be compared by a single numerical rating.
- Supervision could also single out workers with good equipment and personnel, and take steps to improve them.
- The general superintendent had a detailed knowledge of lab efficiency.
- A convenient cost control index was established.
- Supervision could also single out workers with good performance and recommend them for payroll increases or promotions.

The most important advantage in using the rating system was the increase in output on routine physical tests. As shown in the chart above, this went from 6.6 to 10.0 tests/man-hr.—an approximate increase in productivity of 50%. Note: the lack of an increase between 1951 and 1952 is believed partly due to a three-month strike at the refinery during 1952.

For a comparison with the industry at large, a survey of five other laboratories was made in 1950. Table 1 shows that these laboratories, not using a performance-rating system, had an average output of 2.4 tests/man-hr. Although not all these laboratories were running the same tests, at last 80% of the tests were the same, making the comparison valid.

If it is assumed that the cost per test is $1; then for a laboratory with a staff of 25 operators an output increase of only 1 test/man-hr. would permit a weekly saving of $1,000.

There are four steps in setting up a rating system of this type:

1—Establish the norm.
2—Measure the daily output.
3—Analyze and rate.
4—Take positive action.

Table 1—Survey of Test Output from Other Refinery Laboratories

Lab	Tests/Day	No. Operators	Tests/Man-Hour
1	1500	125	1.5
2	203	9	2.8
3	1645	61	3.4
4	460	30	1.9
5	3000	200	1.9
		Average	2.4

Better Lab Productivity

Step 1 Gather the Data and Establish the Norm

EFFICIENCY rating means comparing actual performance against a reasonable standard. This was done at Bayonne by a time and motion study of 120 analytical tests, and 60 physical tests. The results were approved (or altered) by agreement among concerned supervisory personnel. These standards were then used for comparing the output of all operators.

The table at the bottom of the page shows one typical breakdown for determining a performance standard. As can be seen, a factor of 15% was allowed for "slight disturbances and environmental influences" beyond the stop-watch readings.

The expected test output was expressed in "tests/standard-hour."

Terms You Have to Know

Daily output — Time spent in testing procedures, expressed as standard-hours.

Working daily requirement — A symbol—A, B, C, etc.—defining the range of daily output.

Weighted output (WO) — A weighted value classifying daily output, and giving credit for more than normal daily output of seven.

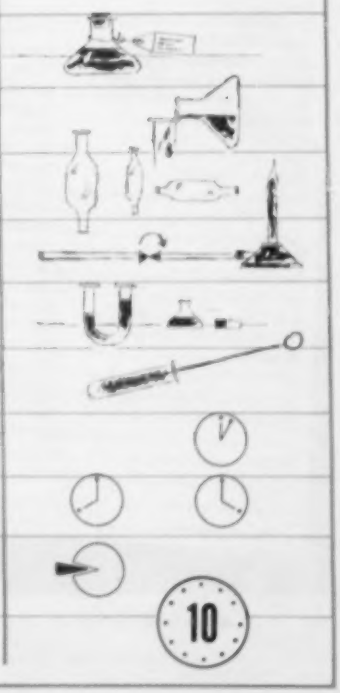
Standard-hour — A working time of 51 minutes (see example below).

Daily requirement (DR) — Per cent of days of the month with a daily output of seven or more standard-hours.

Performance number (PN) — A single numerical expression that allows comparison of individual operators, with respect to monthly performance.

Time and Motion Study Example: Running Kinematic Viscosity

Operation	Time, Minutes
Picking up sample, reading tag, opening container	0.1
Pouring sample from container, preheating	0.5
Selection of proper capillary tube, charging	1.0
Temperature adjustment	0.5
Setting up for flow and level reading	1.0
Evacuate sample and clean tube	2.0
Total Time	5.1
Total Tests/Day	94
(Total number of tests/Day allowing 15% for slight daily disturbances and environmental influences)	80
Expected Tests/Standard-Hour	10



Better Lab Productivity
Step 2

Measure Daily Output; Keep Records

OPERATORS in the control lab were required to keep a daily record of all tests performed. The sheet (see sample) handed in at the end of each shift recorded only how many of each test had been run during the past eight hours. These sheets were "graded" daily against a standard test time (the norm), which had been established before. The result was evidence of the lab operator's *daily output* (see sample analysis sheets).

If some unusual operation, which prevented routine testing, was encountered during the shift, this was recorded under "Remarks." When the sheets were analyzed this time was taken into account in figuring the daily output.

One advantage of keeping a separate record of these unusual procedures was the chance to total this time. The month's end analysis of the hours spent on unusual procedures, then, would tell whether the employment of a special operator was justified, or whether new equipment or rearrangement of existing equipment was required.

THE DAILY WORKSHEET is kept by control laboratory operators for all tests performed. The operator's daily output is then determined by grading the Daily Work Sheet against previously established norms

Three Examples of a Grading Sheet

TEST	NUMBER COMPLETED	TIME STANDARD-HOURS
Viscosities @ 100° F	30	3.00
Viscosities @ 210° F	48	4.80
Total Output	78	7.80
Remarks: (none)		
Working Daily Requirement		A
Viscosities @ 100° F	29	2.90
Viscosities @ 210° F	45	4.50
Total Output	74	7.40

TEST	NUMBER COMPLETED	TIME STANDARD-HOURS
Remarks:		
Stabilized Machine	20 min.	0.33
Checked Electric Timers and Viscosity Tube	20 min.	0.33
Total Miscellaneous Time*	40 min.	0.67
Working Daily Requirement		A

*Miscellaneous time is regarded as part of the viscosity test.

TEST	NUMBER COMPLETED	TIME STANDARD-HOURS
Viscosities @ 100° F	24	2.40
Viscosities @ 210° F	36	3.60
Total Output	60	6.00
Remarks:		
Had difficulty with temperature adjustment of bath*		2.00
Working Daily Requirement		B

*Adjustment time is not considered as part of the basic test time.

Better Lab Productivity

Step 3

Study, Analyze and Then Rate

CONSIDERED by itself, the daily output average for the month (see Step 2) was not satisfactory. There was no indication of either erratic or consistent performance. For this reason a symbol letter was used to classify a *range* of daily output; this was called "Working Daily Requirement." (The use of certain letters was deliberately avoided to prevent similarity to "report card grades": E–Excellent, G–Good, etc.) The correlation of the symbols used is:

Working Daily Requirement	**D** above	**C**	**B**	**A**	**H**	**K**	**L** below
Daily Output—std. hrs.	10	10-8	8	8-7	7-6	6-5	5

As an example of the value of establishing this measurement for erratic performance, consider Table 2, in which the daily output for lab operator "X" is recorded in symbols and hours.

The column in hours shows a total output of 168.71 hrs. for 21 working days, or an average daily output of 8.03 std. hrs. This would be regarded as a good *average* performance.

But, analysis of the Working Daily Requirement symbols shows that in 13 of the 21 working days in the month, the lab operator turned out less than the 7 std. hrs. of work (DR = 62). Since all members of the lab were expected to produce a daily requirement (DR) of at least 75%, operator "X"'s performance for the month was not satisfactory.

Even though he had produced more than the average on some days, his low production for eight days had deprived the laboratory of normal output.

In order to give proper credit for *more* than seven hours of work, and to establish a single figure to compare performances, two other values were computed: Weighted Output (WO) and Performance Number (PN).

Table 3 compares the work of eight different operators. Even though all had more than acceptable Daily Requirements (DR = 100), this analysis does not show who did outstanding work. However, this is determined by computing the Weighted Average and Performance Number. These values clearly show that operator No. 10 had a consistently high output. If these computations had not been made his light would have been hidden under the proverbial bushel.

To aid in discussing an operator's performance without lengthy explanation of the computations involved, the PN (Performance Numbers) were grouped by ratings (see Table 4). Then these comparative terms could be used in verbal discussion of anyone's performance, for corrective action or commendation.

Table 2—Daily Output by Operator "X"

Date	Output Hours	Output Days
1		
2		
3	10.09	D
4	8.34	C
5	7.03	A
6		
7		
8	10.79	D
9	11.69	D
10	6.68	H
11	6.09	H
12	7.57	A
13		
14		
15	6.81	K
16	8.97	C
17	5.88	K
18	9.73	C
19	6.43	H
20		
21		
22	8.12	C
23	5.88	K
24	7.88	A
25	6.50	H
26	6.60	H
27		
28		
29	9.03	C
30	10.03	D
31	8.00	B
Total	168.71	
Average	8.03	62 *DR

Table shows 1 month's output. *DR = Daily Requirements.

Table 3 — Comparison Between Daily Requirement and Performance Number

Operator	No. Days Worked	Working Daily Requirement DR	No. Days in Month for Each Symbol D	C	B	A	H	K	L	WO	PN
1	21	100	0	14	0	7	0	0	0	85	92
3	22	100	0	4	1	17	0	0	0	79	90
4	21	100	1	16	0	4	0	0	0	88	94
10	16	100	13	3	0	0	0	0	0	106	103
11	21	100	6	12	0	3	0	0	0	93	96
16	19	100	0	19	0	0	0	0	0	90	95
18	21	100	0	9	0	12	0	0	0	82	91
22	5	100	0	0	0	5	0	0	0	75	88

Table 4—Verbal Expressions for PN Values

Excellent	101 thru 105
Very Good	96 thru 100
Good	91 thru 95
Satisfactory	85 thru 90
Acceptable	70 thru 84
Unacceptable	60 thru 69
Poor	50 thru 59
Very Poor	49 or lower

Better Lab Productivity
Step 4

Take Positive Action on the Findings

BY use of a single and inclusive rating factor, the PN, it is possible to spot three things: (1) the operator whose work needs to improve, (2) the operator who deserves commendation, and (3) the existence of poor laboratory layout or procedure.

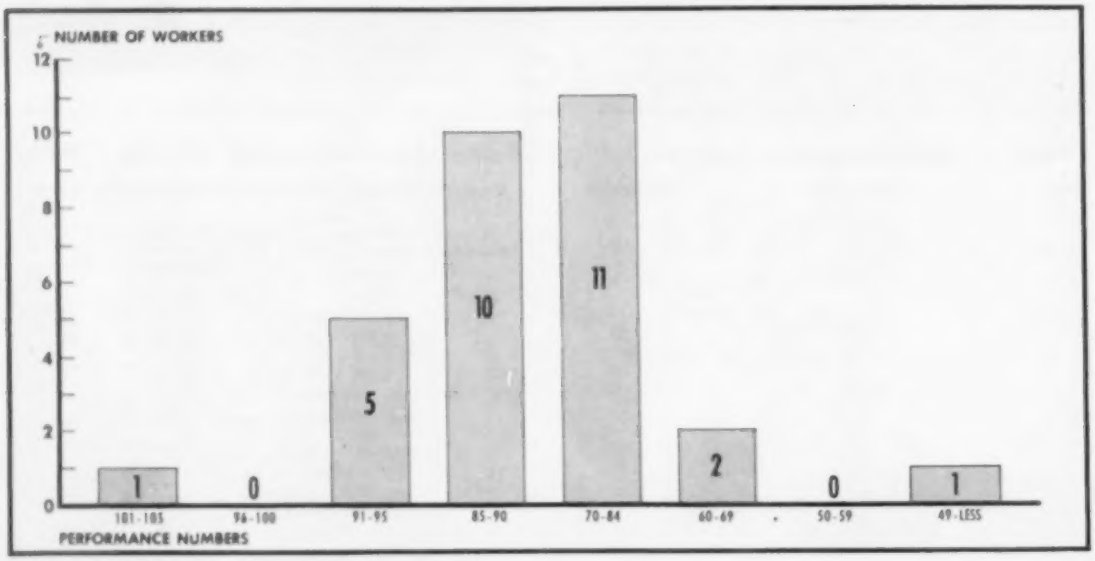
Some of the factors affecting operator output in any lab are backlog of work, inadequate apparatus, poor location of test equipment, and inefficient test scheduling.

At the Bayonne lab of Tidewater Associated Oil we believed that an excess work load was the most effective. Except for control and sales samples, which had to be done immediately, all samples remained untested in the lab for a maximum period of three weeks. Thus there was always a test load greater than the daily available man hours. Our experience showed that this procedure improved testing output.

When physical, corrective measures for the above factors resulted in no improvement of an operator's output, this operator was then analyzed for his attitude toward work, operating technique, familiarity with test procedures, as well as related non-testing activities. A study of these factors generally resulted in a marked improvement in the person's output.

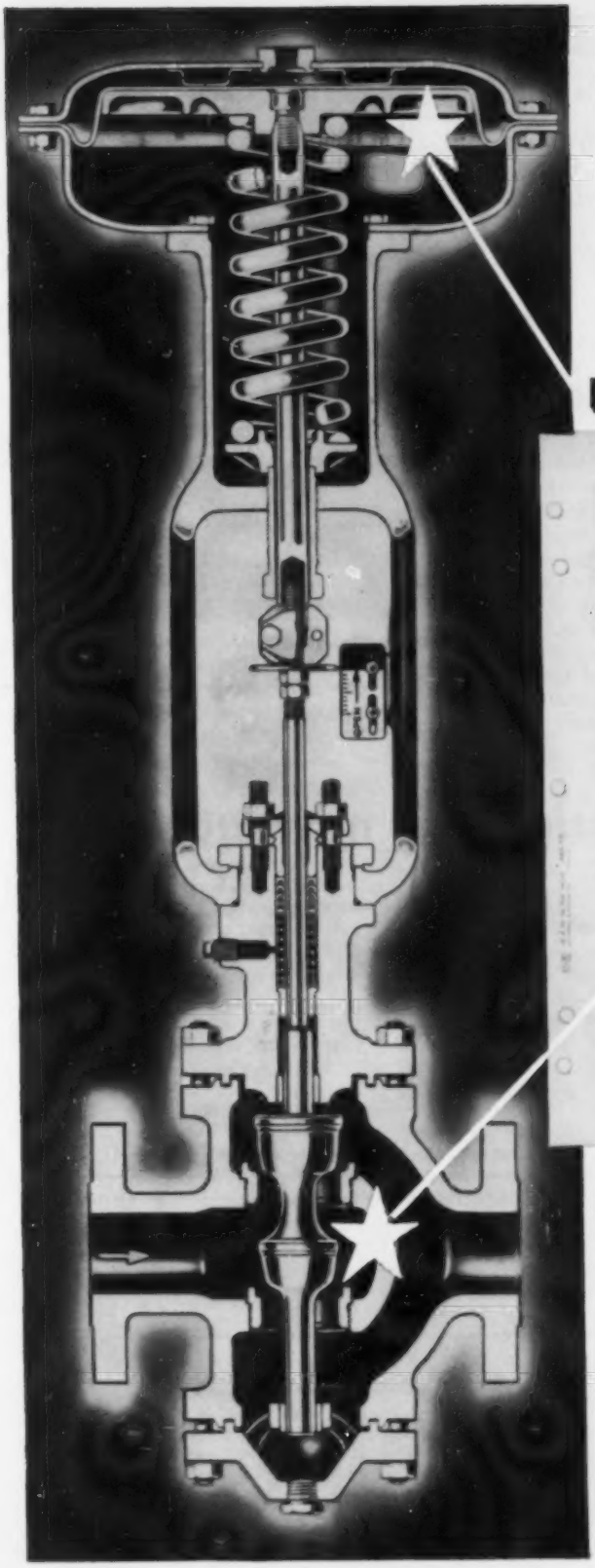
However, there were still some who showed wide fluctuation in their monthly performance. These individuals are always difficult and perplexing cases, usually temperamental, moody, and of erratic behavior. If daily analysis of their work did not show normal performance they were advised of it. Sometimes sympathetic discussion, or an appeal to personal pride, would result in improvement. But the operator who remained unresponsive and would not maintain an acceptable performance, was a candidate for severe corrective action.

An excellent performance, by the same system, would usually single out those who deserved salary increases or promotions. A plot of the performance numbers for 30 operators during a typical month (see chart) shows that the ratings agreed well with normal distribution curves. This close agreement also justifies the basic performance standard of DR = 75%.



Meet the Author

David Rothbard was supervisor for 20 years of the Bayonne control lab of Tidewater Associated Oil Co. Prior to that he was in Tidewater's research and development department for 12 years. Earlier this year he retired. Mr. Rothbard received his bachelor's in chemistry at Brooklyn Polytechnic Institute, and worked at the National Bureau of Standards in Washington, D. C. (in 1920-1921), on test development, and lubrication.



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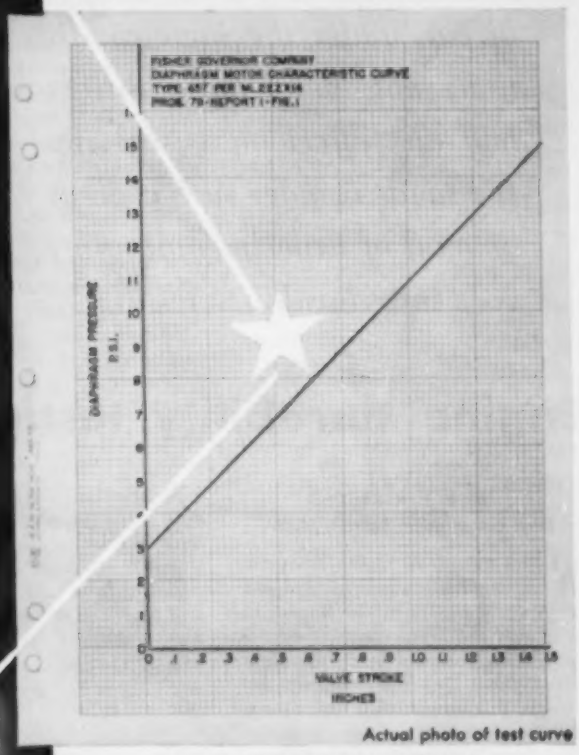

Actual photo of test curve

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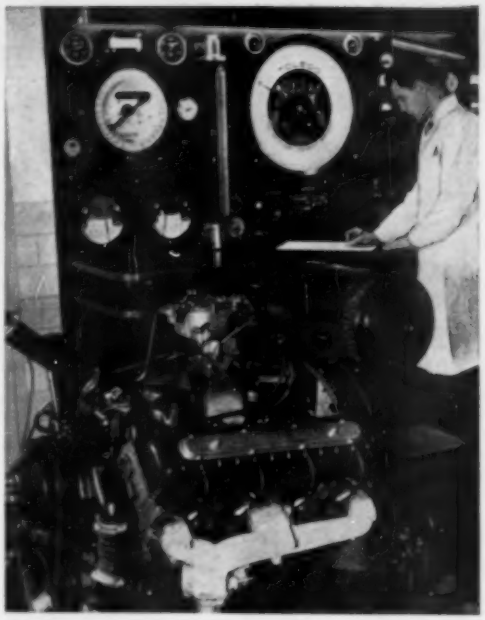
Recently seven experimental fuel additives were tested in a fleet of passenger cars under severe conditions. Tests showed that four of the additives reduced exhaust valve life, whereas three actually increased it 25% to 50%. In another make of car, under the same conditions, not one of the additives had any effect on valve life. It's small wonder such a great amount of experimental effort goes into durability testing.



Most durability testing of new additives must be conducted in multicylinder engines. Priority is given to operation of these engines in the laboratory rather than on the road because it is easier to maintain close control of test conditions.

Engine durability testing for new additives

By R. V. KERLEY
Ethyl Corporation, Detroit, Mich.

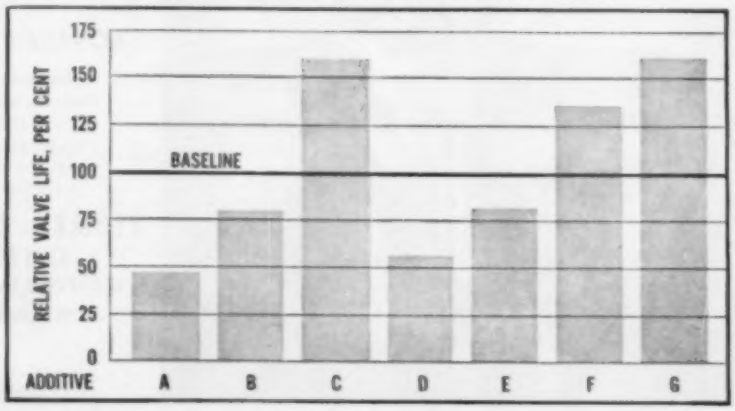
AS THE TREND to higher compression engines has continued, many additives have been developed to meet new requirements. Scavengers have been designed to increase exhaust valve life, and additives developed to inhibit rusting, to increase fuel stability, and to prevent carburetor icing. Other additives have been developed to suppress spark plug fouling and deposit-induced surface ignition. Undoubtedly, new additives will be discovered to supplement or replace many of those currently in use.

Durability testing vital

Development of any new additive requires a great deal of testing before the product can be marketed with the assurance that it will be beneficial to all users. From past experience it has been found that much of the total development effort must be spent on the durability aspects of the additive. That's because very small concentrations of different chemicals may either improve or drastically reduce engine durability as shown in Figure 1. In some cases it has been shown that as little as one gallon of additive in 50,000 gallons of fuel may reduce exhaust valve life to half of normal. On the other hand, increased amounts of the same additive may actually double normal life (Fig. 2).

Of course, a great many factors other than valve life must be considered in establishing the commercial possibilities of fuel additives. For instance, an additive's effect on engine wear, exhaust valve lash loss, combustion-chamber deposits, fuel economy, oil economy, the exhaust

FIG. 1. Effect of seven fuel additives on exhaust valve life



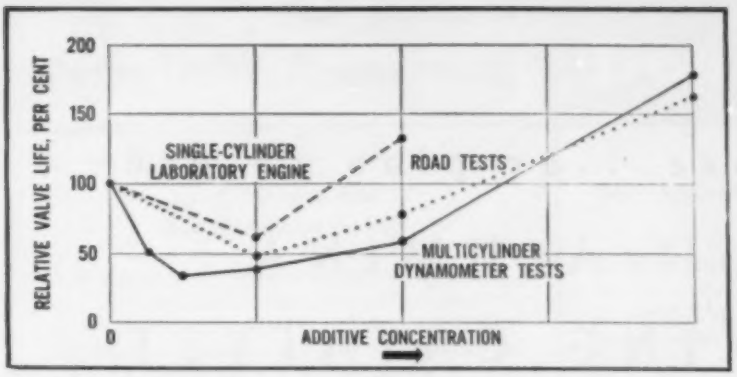


FIG. 2. Effect of full additive concentration on valve life with three different engines and different operating conditions.

system and even rear-bumper corrosion from exhaust products. If an additive registers a marked adverse effect on any of these important factors, it must be eliminated from further consideration.

Durability testing tools

Tools available for use in durability problems are generally put in the following order: (1) Chemical laboratory tests (2) Single-cylinder engine tests (3) Multicylinder engine laboratory tests (4) Fleet tests.

Chemical laboratory tests. These tests will generally supply all the needed information concerning the effect of additives on fuel storage stability, metal corrosion, and deterioration of rubber-like parts.

Single-cylinder engines. The Ethyl Corporation uses single-cylinder engines for preliminary testing of additives for positive and negative effects on valve durability. These engines permit close control of test conditions, require relatively small quantities of precious experimental materials frequently required. However, single-cylinder engines never act exactly like multicylinder engines. So the results from single-cylinder engines are regarded only as indications of durability effects until the data are substantiated by multicylinder engine tests.

Multicylinder laboratory tests. Most of the durability effort must be conducted in multicylinder engines. Therefore, in most laboratories, scheduling gives priority to operation of these engines in the laboratory rather than on the road. There are two reasons for this preference: In the lab you can maintain closer control of engine test conditions and since these tests are generally considered more reproducible, fewer tests are necessary to separate promising materials from those giving less satisfactory results.

Fleet tests. Final step in the development of the additive is to test it with vehicles on the road. This step is important for two reasons. It acts as a check on the conditions chosen in the laboratory tests and it provides results which are much more acceptable to the purchaser of the product.

Obviously, no single test or any group of tests on a single engine should be used to predict the effect of additives on engine durability. Thousands of hours of dynamometer testing and millions of miles of road performance in a wide variety of engines must be conducted before a company can be sure its new product will benefit the user. And even after extensive testing has been done, sound judgment based on experience and knowledge must be exercised.

Send for a reprint of our technical paper entitled "Fuel Additives and Engine Durability." It will give you the philosophy of durability testing, choice of test equipment and actual test schedules used. Address your request to Box 13, Ethyl Corporation, 100 Park Ave., New York, N. Y. No charge.

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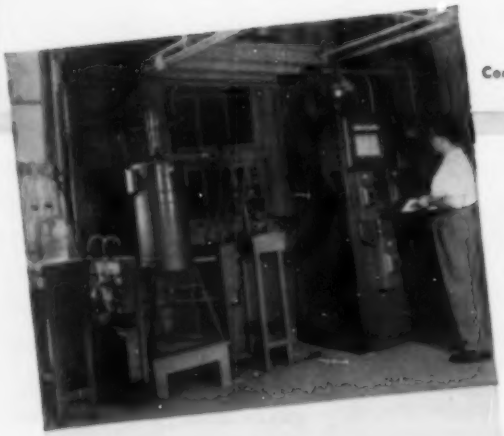

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Butane to Butene and Butadiene By Catalytic Dehydrogenation

. . . including data on process flow, catalyst, operating conditions, process variables, yields, utilities, economics, references. p. 1929

Just an Old Tower?

Yes, but it helps Socony Mobil check air pollution at the East Chicago refinery. See Plant Practices for this and other "home grown" ideas. p. 1933

Better Feed for Cat Cracking

New patent issued to Esso Research & Engineering Co. discloses a process for improving catalytic cracking feedstocks by total removal of aromatics to reduce potential coke formation. See Patents for details. p. 1949

Some Good Meetings Coming Up

The busy oil man's calendar shows many important conferences on the winter schedule. Check on your favorite technical society and its activities, then make your own plans so you won't miss out on anything of value. p. 1957

New K-Factor Charts

. . . for equilibrium vaporization of petroleum hydrocarbons, and for mixtures of non-hydrocarbons commonly found in petroleum. Prepared for the NGAA by G.G. Brown, this data will probably replace older information. Books. p. 1961

New Sand-Blasting Tool

. . . will clean pipe in sizes up to 12-in. diameter. The tool does not rotate, but rather creates a whirling action in the abrasive. Also more than 50 other new ideas in equipment, supplies, and literature. What's New! p. 1965

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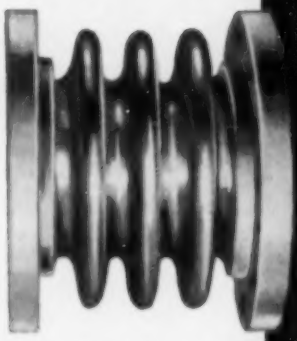

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- Protects Costly Equipment Against Excessive Pipe Stresses
- Prevents Loss of Valuable Materials Flowing Through Pipe Lines
- Eliminates Maintenance Costs

BADGER MANUFACTURING COMPANY

Original and Sole Manufacturer of Badger Expansion Joints

230 BENT STREET, CAMBRIDGE 41, MASS. • 60 EAST 42nd STREET, NEW YORK 17, N.Y.

Representatives in Principal Cities

KUPLEX

the new Tretolite metal deactivator

Kuplex deactivates harmful copper and copper compounds by a chelating action. This prevents hydrocarbon deterioration caused by metal catalyzed oxidation. Kuplex prevents the undesirable reactions by combining with the dissolved copper to form a stable chelate. If copper is present, the use of Kuplex will reduce the amount of anti-oxidant necessary to effect desired stability.

Kuplex can be effectively used to deactivate copper in hydrocarbons such as

GASOLINE • KEROSINE
JET FUEL • DIESEL OIL
FURNACE OIL • TURBINE OIL

Kuplex effectively protects the quality of hydrocarbon products for as little as 2 mills per barrel. This insurance against customer dissatisfaction is worth many times its low cost.

For complete technical data, samples and prices, ask your Tretolite refinery service engineer or write to

TRETOLITE COMPANY

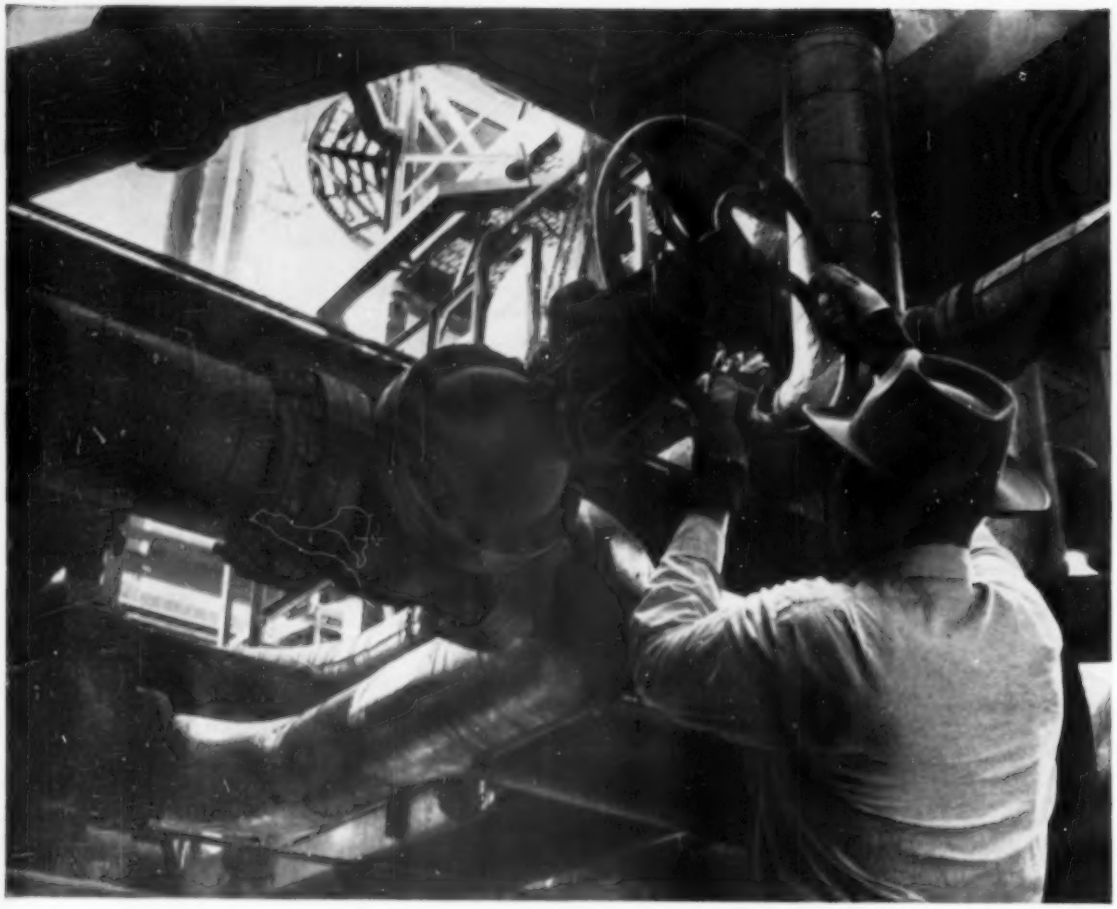
A DIVISION OF PETROLITE CORPORATION

369 Marshall Avenue, St. Louis 19, Missouri
5515 Telegraph Road, Los Angeles 22, California

chemicals and services for the petroleum industry

Desalting • Demulsifying • Corrosion Preventives • Scale Inhibiting
Asphalt Additives • Fuel Oil Additives • Water De-oiling • Paraffin Removal • Production Stimulation • Bactericides • Metal Conditioners

 (To obtain more data on advertised products see page 1964)



8 years on 600° F. oil...
and never a wrench on these Crane Valves

THE CASE HISTORY—Here is one of the 8-inch, 300-pound Crane steel gate valves in service on a crude unit at Cities Service Oil Co.'s Ponca City refinery. They're on the 600° F. oil transfer line from the furnace where they were installed more than 8 years ago.

The refinery's engineers chose No. 33X gates to stop a condition of continual leakage at the packing glands with other makes of valves formerly used. They did that—and more. In service continuously, the Crane valves have needed no maintenance whatsoever—have never leaked—and to date are giving tight closure with easy operation.

There's a difference in steel gate valves that doesn't show on the surface. In Crane valves, it's in the 100-year skill with which Crane makes castings . . . the care given to design . . . the closely controlled heat treating and finishing of Crane Exelloy seating. These added values account for the outstanding low-cost performance record of Crane valves in the petroleum industry.

In steel gates, globes, angles and checks, Crane gives you complete selection—in sizes up to 24 inches—in pressure classes up to 2500 pounds. Your local Crane Representative can give you valuable help in specifying and ordering these valves.

Crane Co., General Offices, Chicago 5, Ill. Branches and Wholesalers in all areas.

CRANE CO.

VALVES • FITTINGS • PIPE
KITCHENS • PLUMBING • HEATING

CRANE'S FIRST CENTURY...1855-1955

1926 *(To obtain more data on advertised products see page 1964)* PETROLEUM PROCESSING, December, 1955

Process—Making butadiene and
catalytic dehydrogenation of norm

Process Flow—Fresh n-butane
butane-butene recycle from the bu
unit. The mixture is pumped
quench oil exchanger, then heate
a furnace. Hot feed passes thro
Effluent is cooled—by contact wi
in the quench tower—, then en
drum before the 4-stage compress

Overhead from the final comp
drum has C_4+ recovered in a
sorber stripper. Bottoms from
enter stripper reflux accumulator,
is depropanized, then goes to th
covery and purification system. Se
fication systems are satisfactory.

Catalyst—Made of active alumi
with 18-20% chromic oxide, made
pellets. Normal life is about 6 m

Small amounts of carbon dioxi
in the feed do not harm catalyst ac
decreases activity temporarily. S
iron cause increased coke and ligh
catalyst spalling and breakage.

Regeneration—Reactor operation
three cycles, 1) reaction, 2) re
3) purging. On-stream reactor p
to 7-15 minutes to keep the tem
during reaction less than 50°F.

Regeneration is by burning
catalyst with air preheated by
the air stream. Hydrocarbons are
from the reactor prior to regener
bustion gases are purged by a ste
regeneration.

Motor-operated valves—contro
timer—program the reaction, pur
eration sequence.

	Fresh Feed wt. %
Hydrogen	——
Methane	——
Ethane-ethene	——
Propane-propene	——
Iso-butane	0.5
Iso-butene	——
N-butenes	——
N-butane	99.5
Butadiene	——
C_5+	——
Coke	——
Total	100.0

(1) Inclu

and/or butenes by
normal butane.

ane feed mixes with
he butadiene recovery
ed through a feed-
heated to 1150°F. in
through the reactor.
ct with circulating oil
n enters a knockout
pression section.
compressor knockout
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rom knockout drum
ator. Stripper effluent
to the butadiene re-
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tory.

alumina impregnated
made into cylindrical
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dioxide and ammonia
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ration goes through
2) regeneration, and
tor periods are held
temperature change
°F.
ing coke from the
by burning fuel in
s are vacuum purged
generation, and com-
a steam ejector after

ontrolled by a cycle
, purging, and regen-

Operating Conditions—Typical conditions for producing butadiene or butene are:

	Butadiene	Butene
Ave. Temperature, °F.	1125	1125
Pressure	5 in. Hg abs	10 psig
Space velocity, vol. feed/vol. cat./hr.	1.0-1.5	1.5-2.0
On-stream time, minutes	8-10	8-10

Process Variables—Temperatures of 1150-1100°F. and pressures of 2.5 psia favor butadiene production. Butene, cracked products and coke yields increase with pressure, butadiene yields decrease.

Pressures of 5-10 psig are used to produce butenes. For making butadiene and butenes at the same time, the low pressure (2.5 psia) is used and butenes are removed from the recycle stream to prevent their conversion to butadiene.

Space velocity increases have little effect on the main reaction over a wide range, but reduce side reactions—particularly coke.

Product Yields—With fresh n-butane feed and mixed butane-butene recycle, a butadiene yield of 11-11.5% per pass is obtained. Increased butene in the feed increases butadiene yields. Butadiene in the feed is mostly destroyed, giving coke and cracked products. Typical butadiene yields are shown in the table below, as well as butene yields for non-recycle operation, and combined butadiene-butene yields.

Equipment—Reactors have steel shells lined with ceramic tile. Exposed reactor steel would form an active oxide surface—because of alternate reducing and oxidizing conditions at elevated temperatures—which would promote cracking and coking.

Utilities—Requirements for the dehydrogenation and cuprous ammonium acetate purification sections are shown in the table above.

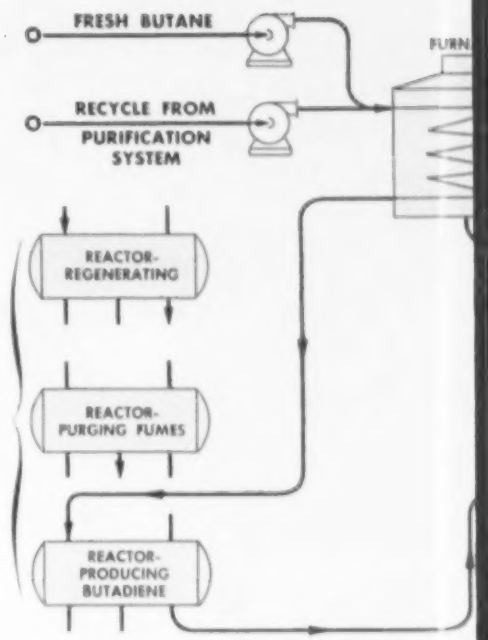
Economics—The table on p. 1929 shows the cost of butadiene from n-butane, assuming cuprous ammonium acetate purification and omiting operating capital and Federal taxes. Similar cost information for making only butenes, or various proportions of butenes and butadiene, and for making iso-butene from iso-butene are available in the literature[2].

Utilities Needed for 26,500 tons/yr. Butadiene Production

Onstream time 87%

	Dehydrogenation	Purification
Cooling water, gpm	6,000	9,300
Power, kw	7,150	2,600
Steam, lb./hr.		
125 psig needed		
Maximum	19,500	—
Average	4,800	—
125 psig produced	71,000	—
15 psig needed	—	28,000
Fuel, MBtu/hr.		
Needed	235	—
Produced	125	—
Net needed	110	—
Boiler feed water, lb./hr.	78,800	—
Chemicals, lb./sd		
Copper shot	—	250
Ammonia	—	1,500
Acetic acid	—	290
Inhibitor	—	67
Catalyst, lb./sd		
Active	1,800	—
Inert	2,240	—

Note: Air blower, compressors (including refrigeration) and all pumps, except knockout drum liquid discharge pumps, are motor driven.



Installations—Two 15,000 ton/yr. butadiene plants built during World War II. The Sun Oil Co. plant at Toledo, Ohio was dismantled after the war. The Standard Oil Co. (Calif.) plant at El Segundo, Calif. now operates for combined butene-butadiene product. Plans for new plants have been announced for Chemische Werke Huels A.G. at Marl Kreis Recklinghausen, West Germany—36,000 metric tons/yr. butadiene—and Texas Butadiene & Chemical Corp. near Houston, Texas—43,000 ton/yr. butadiene or a combined product of 17,000 ton/yr. butadiene and 118,000 ton/yr. butenes—scheduled for 1957.

Licensor—Houdry Process Corp., Phila., Pa.

References—Articles published about the Houdry dehydrogenation process include:

(1) Hornaday, George F., "Take Another Look At the Houdry Dehydrogenation Process," *Petroleum Refiner*, Sept., 1953, pp. 130-134.

(2) Hornaday, G. F., "Economics of Houdry Dehydrogenation," *Petroleum Refiner*, Dec., 1954, pp. 173-176.

(3) Lassiat, R. C., and F. D. Parker, "Butane Dehydrogenation By the Houdry Process," *Petroleum Refiner*, Nov., 1944.

Butadiene from Normal Butane

h Feed t. %	Recycle wt. %	Total Feed wt. %	Product wt. %	Final yield, wt. % on fresh n-C_4	
—	—	—	1.9	10.1	
—	—	—	1.0	5.3	
—	—	—	1.1	5.9	
—	—	—	1.1	5.9	
0.5	(1)	(1)	(1)	—	
—	(1)	(1)	(1)	—	
—	41.4	33.6	33.6	—	
9.5	57.9	65.8	47.0	—	
—	0.7	0.6	11.1	55.8	
—	—	—	0.5	2.7	
—	—	—	2.7	14.3	
0.0	100.0	100.0	100.0	100.0	

(1) Included in n-C_4 fractions

Butenes from Normal Butane

Fresh Feed wt. %	Product wt. %	Final yield[1] wt. % fresh n-C_4	
—	1.6	3.4	
—	2.4	5.1	
—	2.7	5.8	
—	3.4	7.2	
0.5	0.3	trace	
—	0.2	trace	
—	32.0	68.2	
99.5	52.6	—	
—	2.0	4.1	
—	0.6	1.3	
—	2.2	4.7	
100.0	100.0	100.0	

(1) At high conversion. Ultimate yield increases at lower conversion/pass and lower pressure.

Butenes and Butadiene from Normal Butane

Fresh Feed wt. %	Recycle wt. %	Total Feed wt. %	Product wt. %	Final yield, wt. % on fresh n-C_4	
—	—	—	2.1	7.4	Hydrogen
—	—	—	1.4	4.9	Methane
—	—	—	1.5	5.3	Ethane-ethene
—	—	—	1.6	5.6	Propane-propene
0.5	(1)	(1)	(1)	—	Iso-butane
—	(1)	(1)	(1)	—	Iso-butene
—	35.6	25.5	34.9	33.1	N-butenes
99.5	63.7	74.0	45.6	—	N-butane
—	0.7	0.5	9.8	32.7	Butadiene
—	—	—	0.5	1.8	C_5+
—	—	—	2.6	9.2	Coke
100.0	100.0	100.0	100.0	100.0	Total

(1) Included in n-C_4 fractions

Process—Making butadiene and/or butenes by catalytic dehydrogenation of normal butane.

Process Flow—Fresh n-butane feed mixes with butane-butene recycle from the butadiene recovery unit. The mixture is pumped through a feed-quench oil exchanger, then heated to 1150°F. in a furnace. Hot feed passes through the reactor. Effluent is cooled—by contact with circulating oil in the quench tower—, then enters a knockout drum before the 4-stage compression section.

Overhead from the final compressor knockout drum has C_4+ recovered in a conventional absorber stripper. Bottoms from knockout drum enter stripper reflux accumulator. Stripper effluent is depropanized, then goes to the butadiene recovery and purification system. Several such purification systems are satisfactory.

Catalyst—Made of active alumina impregnated with 18-20% chromic oxide, made into cylindrical pellets. Normal life is about 6 months.

Small amounts of carbon dioxide and ammonia in the feed do not harm catalyst activity, but water decreases activity temporarily. Small amounts of iron cause increased coke and light gas, and cause catalyst spalling and breakage.

Regeneration—Reactor operation goes through three cycles, 1) reaction, 2) regeneration, and 3) purging. On-stream reactor periods are held to 7-15 minutes to keep the temperature change during reaction less than 50°F.

Regeneration is by burning coke from the catalyst with air preheated by burning fuel in the air stream. Hydrocarbons are vacuum purged from the reactor prior to regeneration, and combustion gases are purged by a steam ejector after regeneration.

Motor-operated valves—controlled by a cycle timer—program the reaction, purging, and regeneration sequence.

Operating Conditions—Typical conditions for producing butadiene or butene are:

	Butadiene	Butene
Ave. Temperature, °F.	1125	1125
Pressure	5 in. Hg abs	10 psig
Space velocity, vol. feed/vol. cat./hr.	1.0-1.5	1.5-2.0
On-stream time, minutes	8-10	8-10

Process Variables—Temperatures of 1150-1100°F. and pressures of 2.5 psia favor butadiene production. Butene, cracked products and coke yields increase with pressure, butadiene yields decrease.

Pressures of 5-10 psig are used to produce butenes. For making butadiene and butenes at the same time, the low pressure (2.5 psia) is used and butenes are removed from the recycle stream to prevent their conversion to butadiene.

Space velocity increases have little effect on the main reaction over a wide range, but reduce side reactions—particularly coke.

Product Yields—With fresh n-butane feed and mixed butane-butene recycle, a butadiene yield of 11-11.5% per pass is obtained. Increased butene in the feed increases butadiene yields. Butadiene in the feed is mostly destroyed, giving coke and cracked products. Typical butadiene yields are shown in the table below, as well as butene yields for non-recycle operation, and combined butadiene-butene yields.

Equipment—Reactors have steel shells lined with ceramic tile. Exposed reactor steel would form an active oxide surface—because of alternate reducing and oxidizing conditions at elevated temperatures—which would promote cracking and coking.

Utilities—Requirements for the dehydrogenation and cuprous ammonium acetate purification sections are shown in the table above.

Economics—The table on p. 1929 shows the cost of butadiene from n-butane, assuming cuprous ammonium acetate purification and omiting operating capital and Federal taxes. Similar cost information for making only butenes, or various proportions of butenes and butadiene, and for making iso-butene from iso-butene are available in the literature[1].

Utilities Needed for 26,500 tons/y Butadiene Production

Onstream time 87%

	Dehydrogenation	Purificat
Cooling water, gpm	6,000	9,300
Power, kw	7,150	2,600
Steam, lb./hr.		
125 psig needed		
Maximum	19,500	——
Average	4,800	——
125 psig produced	71,000	——
15 psig needed	——	28,000
Fuel, MBtu/hr.		
Needed	235	——
Produced	125	——
Net needed	110	——
Boiler feed water, lb./hr.	78,800	——
Chemicals, lb./sd		
Copper shot	——	250
Ammonia	——	1,500
Acetic acid	——	290
Inhibitor	——	67
Catalyst, lb./sd		
Active	1,800	——
Inert	2,240	——

Note: Air blower, compressors (including refrigerati and all pumps, except knockout drum liquid discha pumps, are motor driven.

Installations—Two 15,000 ton/yr. butadiene pla built during World War II. The Sun Oil Co. pl at Toledo, Ohio was dismantled after the w The Standard Oil Co. (Calif.) plant at El Segun Calif. now operates for combined butene-bu diene product. Plans for new plants have be announced for Chemische Werke Huels A.G. Marl Kreis Recklinghausen, West Germany 36,000 metric tons/yr. butadiene—and Te Butadiene & Chemical Corp. near Houston, Te —43,000 ton/yr. butadiene or a combined pr uct of 17,000 ton/yr. butadiene and 118,0 ton/yr. butenes—scheduled for 1957.

Butadiene from Normal Butane

	Fresh Feed wt. %	Recycle wt. %	Total Feed wt. %	Product wt. %	Final yield, wt. % on fresh n-C_4
Hydrogen	——	——	——	1.9	10.1
Methane	——	——	——	1.0	5.3
Ethane-ethene	——	——	——	1.1	5.9
Propane-propene	——	——	——	1.1	5.9
Iso-butane	0.5	(1)	(1)	(1)	——
Iso-butene	——	(1)	(1)	(1)	——
N-butenes	——	41.4	33.6	33.6	——
N-butane	99.5	57.9	65.8	47.0	——
Butadiene	——	0.7	0.6	11.1	55.8
C_5+	——	——	——	0.5	2.7
Coke	——	——	——	2.7	14.3
Total	100.0	100.0	100.0	100.0	100.0

(1) Included in n-C_4 fractions

Butenes from Normal Butane

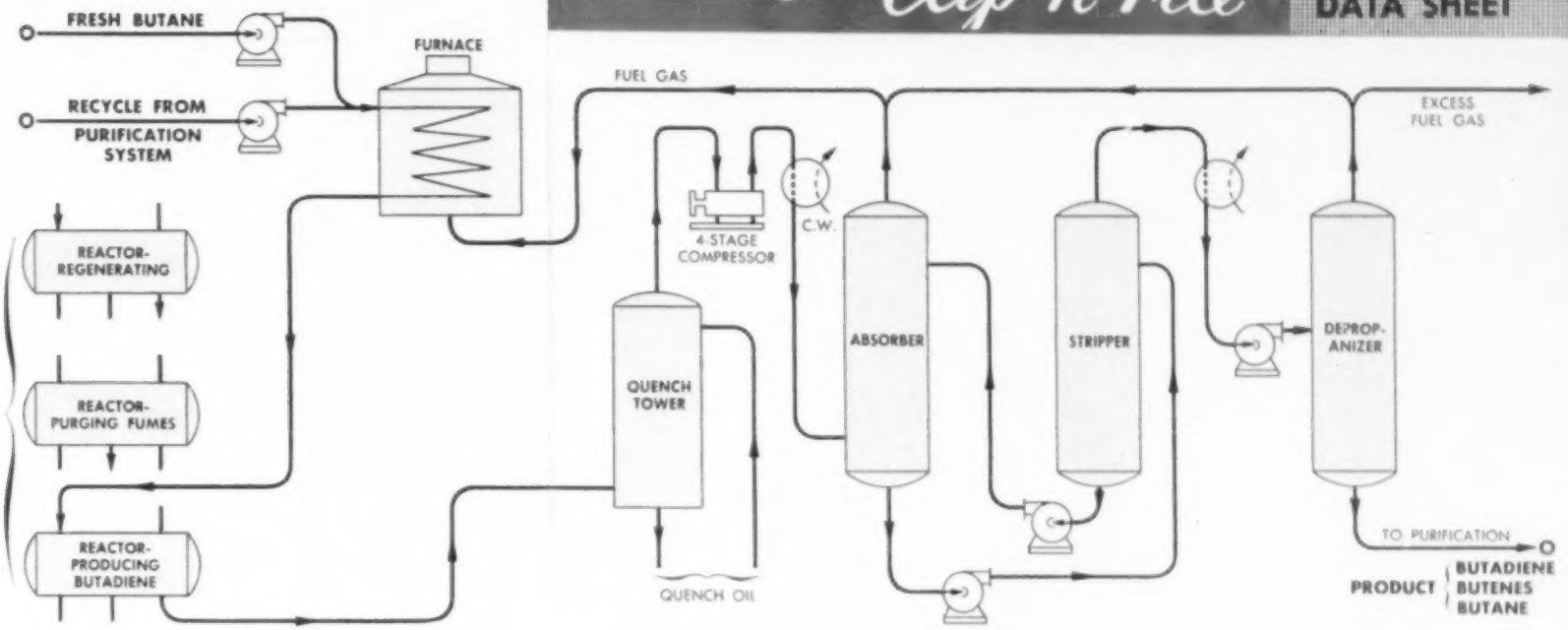
Fresh Feed wt. %	Product wt. %	Final yield[1] wt. % fresh n-C_4
——	1.6	3.4
——	2.4	5.1
——	2.7	5.8
——	3.4	7.2
0.5	0.3	trace
——	0.2	trace
——	32.0	68.2
99.5	52.6	——
——	2.0	4.3
——	0.6	1.3
——	2.2	4.7
100.0	100.0	100.0

(1) At high conversion. Ultimate yield increases at lower conversion/pass and lower pressure.

Butenes and Butadien

Fresh Feed wt. %	Recycle wt. %	Tota w
——	——	—
——	——	—
——	——	—
——	——	—
0.5	(1)	
——	(1)	
——	35.6	
99.5	63.7	
——	0.7	
——	——	—
——	——	—
100.0	100.0	1

(1) Included in n-C_4 fractions



Butadiene and Butenes

By Direct Dehydrogenation of Butane

UNFOLD ← **FOR START OF PROCESS DESCRIPTION**

Licensor—Houdry Process Corp., Phila., Pa.

References—Articles published about the Houdry dehydrogenation process include:

(1) Hornaday, George F., "Take Another Look At the Houdry Dehydrogenation Process," *Petroleum Refiner*, Sept., 1953, pp. 130-134.

(2) Hornaday, G. F., "Economics of Houdry Dehydrogenation," *Petroleum Refiner*, Dec., 1954, pp. 173-176.

(3) Lassiat, R. C., and F. D. Parker, "Butane Dehydrogenation By the Houdry Process," *Petroleum Refiner*, Nov., 1944.

Butadiene Production Costs vs. Plant Size—¢/lb. Butadiene

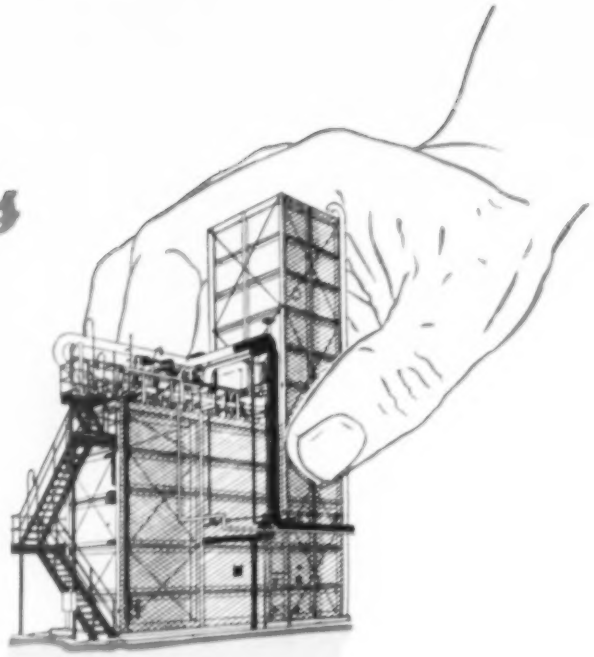
Onstream time 87%

Capacity, ton/yr.	26,500	50,000	75,000	100,000
Investment, $	9,000,000	14,000,000	18,000,000	22,700,000
Fixed charges	4.08	3.35	2.93	2.67
Amortization, 10% investment	1.70	1.40	1.24	1.13
Insurance & taxes, 10% investment	0.51	0.42	0.37	0.34
Maintenance, 6% investment	1.02	0.84	0.74	0.68
General plant overhead	0.85	0.69	0.58	0.52
Operating labor	0.41	0.26	0.19	0.18
Labor, $2.25/hr.	0.27	0.18	0.13	0.12
Supervision, 25% labor	0.07	0.04	0.03	0.03
Overhead, 20% supervision & labor	0.07	0.04	0.03	0.03
Utilities	1.83	1.83	1.83	1.83
Power, @ $.01/kwh	1.40	1.40	1.40	1.40
Cooling water, @ $.02/M gal.	0.26	0.26	0.26	0.26
Steam 125 psig, @ $.25/M lb.	0.02	0.02	0.02	0.02
Steam 15 psig, @ $.25/M lb.	0.10	0.10	0.10	0.10
Steam made (credit), @ $.25/M lb.	—0.25	—0.25	—0.25	—0.25
Net fuel needed, @ $.15/MM Btu	0.24	0.24	0.24	0.24
Boiler feed water, @ $.10/M gal.	0.01	0.01	0.01	0.01
Quench Oil, @ $.10/gal.	0.05	0.05	0.05	0.05
Chemicals	0.19	0.19	0.19	0.19
Catalyst (active), @ $.45/lb.	0.56	0.56	0.56	0.56
Catalyst (inert), @ $.093/lb.	0.03	0.03	0.03	0.03
Royalty to Houdry	0.62	0.62	0.62	0.62
N-butane fresh feed, @ $.055/gal.	2.16	2.16	2.16	2.16
Butadiene manufacturing cost for:				
Butane @ $.045/gal.	9.49	8.61	8.12	7.85
@ **$.055 gal.**	**9.88**	**9.00**	**8.51**	**8.24**
@ $.065/gal.	10.27	9.39	8.90	8.63
@ $.075/gal.	10.67	9.79	9.30	9.03

diene from Normal Butane

Total Feed wt. %	Product wt. %	Final yield, wt. % on fresh n-C_4	
——	2.1	7.4	Hydrogen
——	1.4	4.9	Methane
——	1.5	5.3	Ethane-ethene
——	1.6	5.6	Propane-propene
(1)	(1)	——	Iso-butane
(1)	(1)	——	Iso-butene
25.5	34.9	33.1	N-butenes
74.0	45.6	——	N-butane
0.5	9.8	32.7	Butadiene
——	0.5	1.8	C_5+
——	2.6	9.2	Coke
100.0	100.0	100.0	Total

An *Air Products* OXYGEN PLANT



belongs in this picture

Is your Company one of the many concerns in the process industries that are contemplating expansion requiring the use of tonnage or high purity oxygen?

If so, the specialized experience of Air Products in this field (based on more than 700 successful installations) can be of substantial help in formulating your plans. An Air Products Oxygen Plant engineered specifically for your particular requirements can be a real money-maker.

We are equipped to design and build:

Large Capacity Tonnage Generators, regardless of size, purity, high or low pressure cycle, with liquid oxygen pumps, if your oxygen should be under pressure

or

"Packaged" High Purity Generators, producing high purity oxygen and nitrogen simultaneously —oxygen delivered safely under pressure by Air Products patented liquid oxygen pumps.

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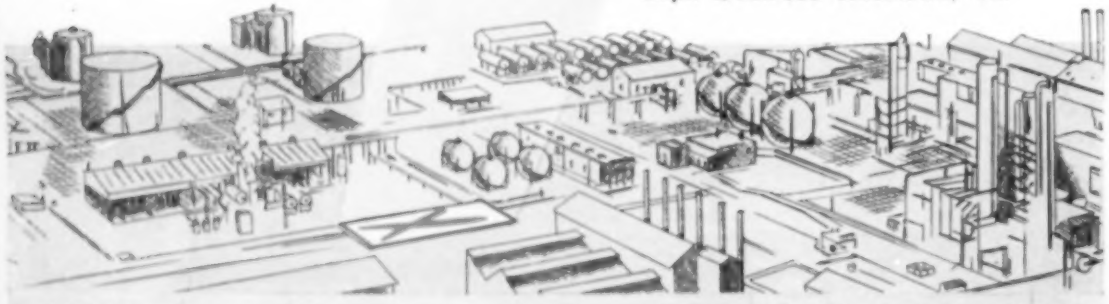
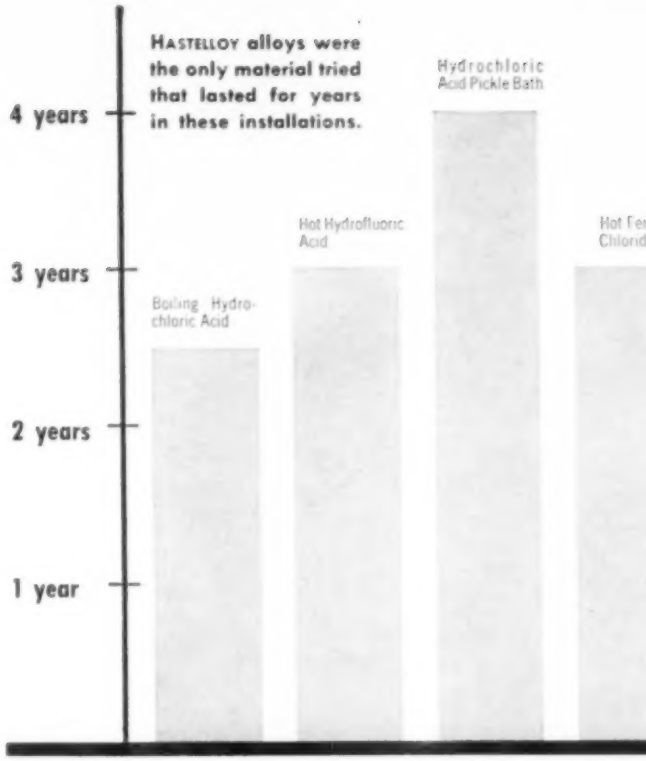


Cost Analyses • Process Design • Apparatus Design • Apparatus Manufacture


HASTELLOY alloys were the only material tried that lasted for years in these installations.
4 years
3 years
2 years
1 year
Boiling Hydrochloric Acid
Hot Hydrofluoric Acid
Hydrochloric Acid Pickle Bath

HASTELLOY Alloys I
under severe corros

These graphs were drawn from data on actual installations of HASTELLOY alloys in severe corrosive media. No other material tried lasted more than six months in most of these installations, some considerably less than this. HASTELLOY alloys lasted for years.

Use of HASTELLOY alloys saved time, money, and production time in all the installations. The graphs do not tell the entire story by any means. Some of the parts made of

HAYNES
TRADE MARK
ALLOYS

HAYNES
A Division of

Chicago - Cleveland

"Haynes" and "Hastelloy" ar

Aerated Sulphuric Acid Pickle Bath
Hot Sulphuric Acid and Hydrogen Chloride
Hot Ferric Chloride
Aluminum Chloride Catalyst

s last for years
osive conditions

ASTELLOY alloys were still going strong when the data ere obtained. In some, corrosion was complicated by brasion, impact, and the presence of contaminants.

Samples for testing HASTELLOY alloys under actual operting conditions are available without obligation. Just let us now what corrosive conditions are involved. For a copy f a booklet describing HASTELLOY alloys, get in touch with he nearest Haynes Stellite Company Office.

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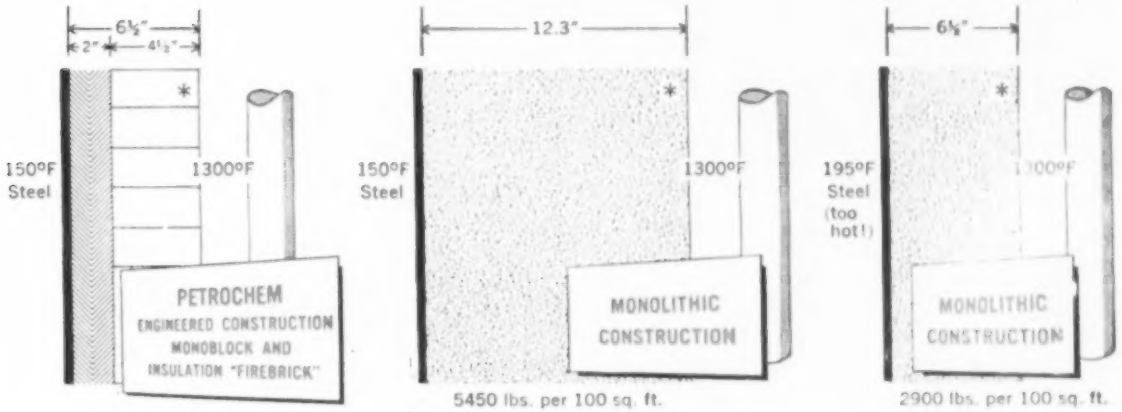
re data on advertised products see page 1964)

In furnaces as in processes compare the design to judge the advantages

As an example:

The wall construction of all Petrochem-Isoflow Furnaces is designed for 150°F maximum outside shell temperature.



1250 lbs. per 100 sq. ft.

5450 lbs. per 100 sq. ft.

2900 lbs. per 100 sq. ft.

*Based on B & W values.

The Petro-Chem design provides a thoroughly engineered wall construction. It is built with two tiers of monoblock supported on 18 inch centers and a circular arched wall of insulating firebrick. The inside of the steel shell is protected from the possibility of corrosion by a one-eighth inch thickness of Staylastic cement. This type of construction, independently supported monoblock and the circular arch of firebrick, bonded with Smoothset mortar, assures optimum efficiency and minimum maintenance.

The use of monoblock and insulating firebrick laid as a circular arch provides many advantages over a one-piece monolithic lining, including:

1—Low weight, 2—Low heat conductivity, 3—High hot crushing strength, 4—Low expansion coefficient, 5—Resilient compressible backing, 6—Long life, 7—Nil maintenance.

Also, this construction has low heat storage capacity, speeds both heating and cooling. Its light weight requires less concrete foundations and steel supports.

Compare and your judgment will affirm
Petrochem-Isoflow Furnaces are Most Efficient by any Comparison

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(To obtain more data on advertised products see page 1964)

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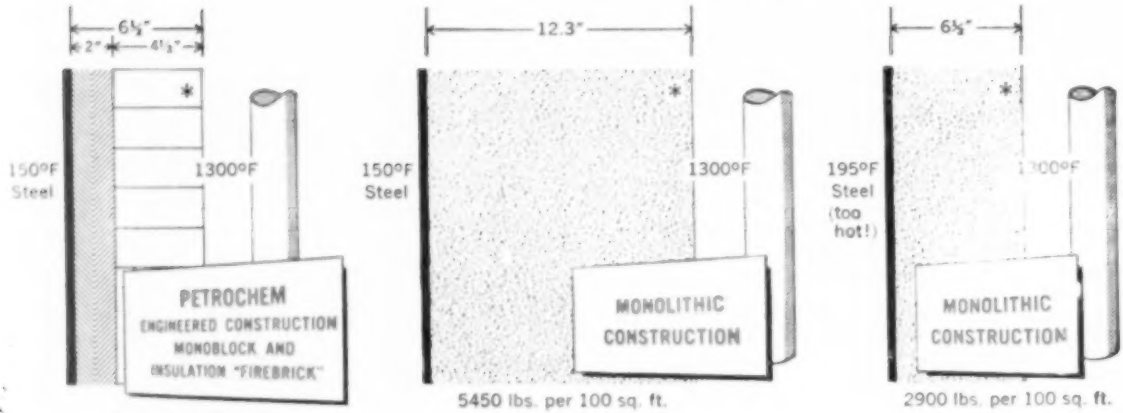

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MONITOR READS wind speed, direction and temperature . . .

TRANSMITTED FROM meteorological equipment on tower

"Weather-Tower" Is Air Pollution Defense

OIL refineries are fair game for "air pollution" and "spraying" claims by both employes and adjacent residential areas.

Typical claims received by Socony Mobil Oil Co.'s East Chicago, Ind., refinery include: (1) employes' claims that the refinery sprayed their cars with a tarry material, the removal of which would also take off the car's wax coat (expensive to the refinery for several hundred cars at roughly $15 per wax job); (2) local housewives claims that refinery emissions on wash day had ruined their clothes; (3) homeowner claims that their plants and shrubs were being killed and the paint on their homes was being ruined by refinery emissions; and many others.

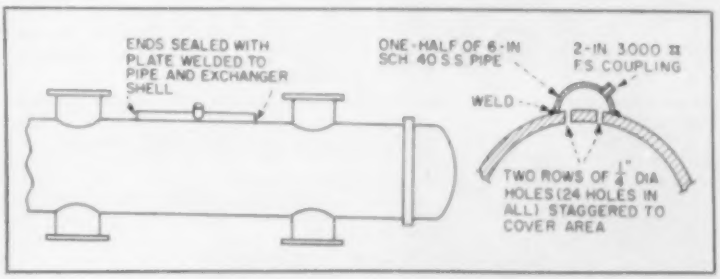
Socony, located in an area with several other refineries as well as metal ore processing plants, was confident that their own contribution to air pollution was negligible. However, sometimes they were hard pressed to counter claims and accusations they considered unfair.

Today, Socony is prepared to evaluate claims against their refinery operation by means of their own "weather-tower."

The weather-tower is an old radio tower, 70 ft. tall and 6 ft. square, which has been converted into a miniature meteorological station. Wind direction is read from an arrow-type vane, wind speed by standard revolving cups, and air temperature by thermocouple. All readings are transmitted to dial gages in the guard room, where periodical readings are taken and recorded.

In cases of claims against the refinery, Socony can now check their own readings to determine if it was possible for them to have been the culprit. Also, they check which units were operating and how (upsets, charge rates, etc.) and local weather reports for the time in question.

If all units were operating normally, and/or the wind direction made a claim against Socony impossible, Socony now has an excellent basis for defense.


ENDS SEALED WITH PLATE WELDED TO PIPE AND EXCHANGER SHELL
ONE-HALF OF 6-IN SCH 40 S.S. PIPE
2-IN 3000 # FS COUPLING
WELD
TWO ROWS OF 1/4" DIA HOLES (24 HOLES IN ALL) STAGGERED TO COVER AREA

BUNDLE WASHER is mounted directly onto exchanger shell

Built-in Unit Cleans Bundles

SEDIMENT in overhead distillate streams tends to settle and collect in "dead" spots in overhead condensers. This sediment can initiate shell-side tube corrosion and reduce heat transfer efficiency.

Buildup of sediment has been reduced by Socony Mobil Oil Co. at their East Chicago, Ind., refinery by perforating condenser horizontal baffle plates (see PETROLEUM PROCESSING, November, 1955, page 1770). Occasionally, however, baffle plate perforation alone does not produce enough turbulence to eliminate sediment buildup.

In cases where "perforating" is inadequate, Socony has installed on-

now...

more effective and economical

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with the

NEW HI-THRUPUT HERRINGBONED MIST ELIMINATOR

Check these important points:

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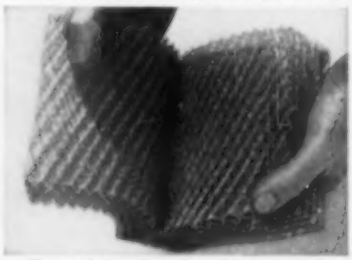
3. Entrainment removal practically 100% over wider operating range.
4. Three to four times longer on-stream life under coking conditions or where solids are present.
5. Lower cost — wires repositioned by Herringbone Fold*.

*U.S. Patent No. 2,565,846, Aug. 28, 1951



These photos show the difference. Full explanation given in our Booklet ME-5.

Send for Revealing Booklet ME-5. Learn how repositioning wires by patented Herringbone process and change in size and contour of mesh openings make this new Mist Eliminator more effective and economical.

METAL TEXTILE CORPORATION

Roselle, New Jersey

Metal Textile Corporation of Canada, Ltd., Hamilton, Ont.

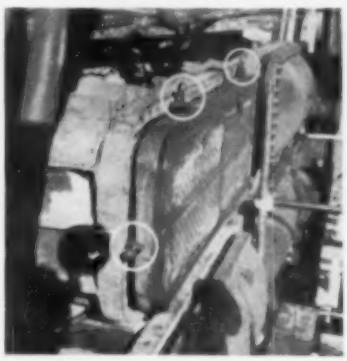
stream "bundle-washers" on overhead condensers.

Bundle-washers are similar to that illustrated in the accompanying drawings. This washer consists of a length of 6-in. Schedule 40 stainless steel pipe cut in half longitudinally. This half-section is welded to the top of the condenser over an area generously drilled with ¼-in. holes. The ends of the half-pipe are welded closed with stainless plate.

Into the center of the half-pipe is welded a 2-in. coupling, onto which is attached a line from a water source having a pressure appreciably greater than that of the condenser shell-side stream.

Water is forced into the washer intermittently, creating a turbulence around the tube bundle to wash the loose sediment out of the condenser.

During the washing procedure, water will collect in the overhead receiver water accumulator, which must be drained regularly.



JACK BOLTS adjusted in place to . . . . . **ALIGN** the exchanger tube bundle

Jack Bolts Help Align Bundles

By A. E. SCHEETZ*

TIME and labor savings have been effected at Sinclair's Marcus Hook, Pa., refinery through the use of jack bolts to align heat exchanger tube bundles.

Shown in the photograph, the jack bolt is basically a stud with a hole tapped perpendicularly through one end and threaded to receive another bolt of smaller diameter.

When this stud is fastened to the exchanger shell channel end flange, the jacking bolt is adjusted to bear on the periphery of the stationary tube sheet.

Three or more jack bolts are spaced equally around the flange stud circle for finer adjustments. These jacking bolts are then manipulated much the same as leveling screws on a transit, until the bundle is properly aligned.

*Mr. Scheetz is Assistant Master Mechanic at Sinclair Refining Co.'s Marcus Hook, Pa., refinery.

Air Helps Clean Fouled Tubes

THE fluid cracking unit air blower turbine at the Big Spring, Texas, refinery of Cosden Petroleum Corp., a 1575 hp. unit, runs full-condensing. When the condenser becomes fouled with deposits on the water-side, a noticeable loss in turbine efficiency quickly becomes evident as reduced flow of regeneration air.

The customary procedure to remove some of the fouling has been to inject a slug of air into the cooling water on the theory that the resulting increase in turbulence, accompanied by frothing, will knock loose some of the fouling on the inside of the tubes.

Cosden's operators have found that a modified technique works better:

Sinclair-BAKER RD 150

PLATINUM CATALYST

guaranteed high yields and long life at high octane levels.

REGENERATES IN SITU . . !

The initial efficiency plus regenerative features of Baker's RD150 are unique and of major importance to the petroleum industry. RD150 assures greater yields at high octane levels . . . exceptionally long periods of operation . . . regeneration in situ! RD150 is a joint development of Baker & Co., Inc. and Sinclair Research Laboratories. It is presently being used by such companies as Sinclair, Socony and Pure Oil.

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 (To obtain more data on advertised products see page 1964)

They wait until the outlet water temperature has climbed about 10 to 15° above the normal 90° F. before blowing. Then the water is shut off and, via a permanent connection-point, yard air is tied in and the condenser is given a good blow for approximately one minute. Then the water is returned. This is repeated twice again at about five-minute intervals.

It is believed that the fouling agent is largely microbiological. Blowing with air allows the fouling agent to "bake" onto the tubes. When the water flow is returned, it produces enough thermal shock to spall the deposit from the tubes and the water carries it away.

This is actually an expedient, however, since eventually it is necessary to take the condenser off the line (operating the unit at greatly reduced throughput meanwhile), open the waterbox, and clean the tubes. However, this practice does extend the interval between regular cleanings.

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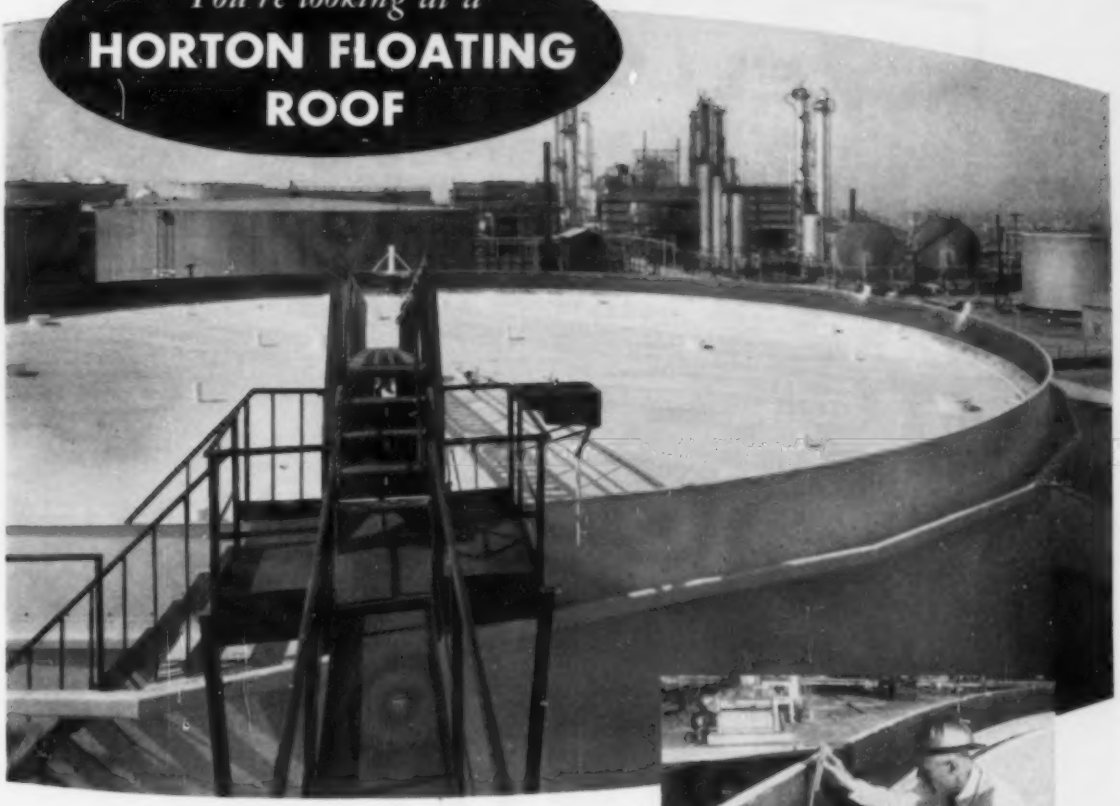

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Horton Floating Roofs are built in three types—Double-Deck, Pontoon and Pan. Write our nearest office for further information.

The man in the view above is holding a carpenter's rule against the side of the tank to demonstrate the snug fit of the Horton Seal. A continuous sealing ring with vertical flexures every 22 inches allows the ring to conform perfectly to the tank shell.

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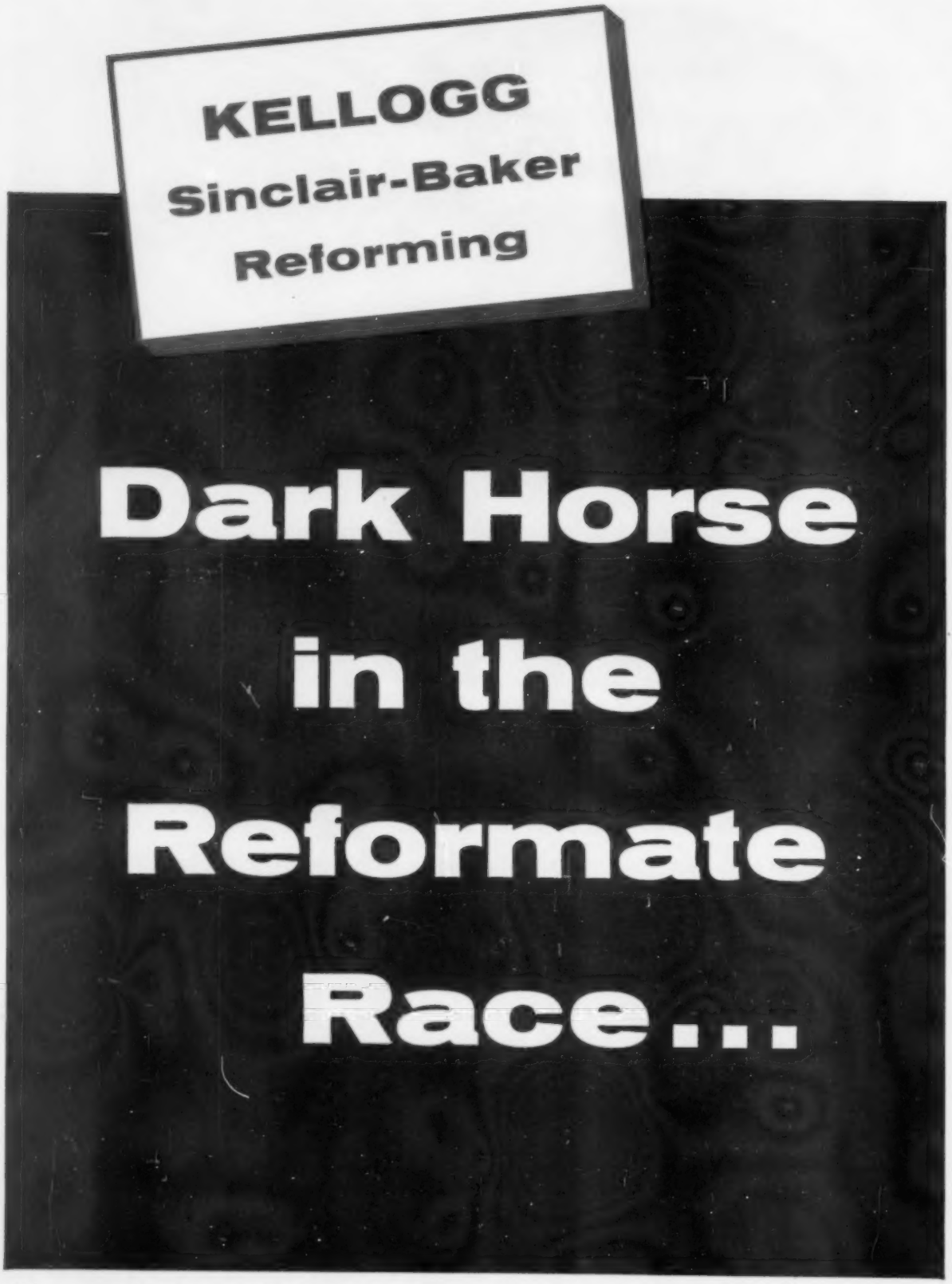
KELLOGG
Sinclair-Baker
Reforming
Dark Horse
in the
Reformate
Race...

New Process and New Catalyst Promise New Records in Production of Low Cost, High Octane Reformates

Although the M.W. Kellogg, Sinclair-Baker process is still too new in service to provide any long-term performance data, and customers' initial findings cannot yet be disclosed, many economic advantages of this catalytic naphtha reforming process have already been firmly established. Any refiner faced with increasing octane yields from present feedstocks, or with getting high octane reformates from lower grade naphthas, will recognize the significance of the following points . . .

Quick Start-Up

Experimental operation is reduced to a minimum. One M. W. Kellogg reforming unit was started on its final test run within two weeks after the catalyst was first charged to the reactors—with octane rating and yield during this 15-day period well in excess of the guarantee.

A Regenerative Catalyst

Sinclair-Baker Platinum Catalyst RD-150 can be regenerated easily and quickly *in situ* to provide many operating cycles, each of many months duration, with negligible loss in catalyst activity. Cost of catalyst per pound in terms of barrels of reformate produced is a major economic factor of the process.

Long Catalyst Life

Sinclair-Baker regenerative catalyst RD-150 has high activity and long initial life. It has been in operation for over one year without supplementing the catalyst. 95 octane reformate can be produced for six months or longer before regeneration is required.

Octane Level

Depending on the feedstock, clear octane ratings above 90 are now being obtained commercially—with 100, and even better, a goal that is entirely feasible and economically practical. *Variability* of octane rating is the keynote of the process, permitting selection of the exact processing conditions for a given naphtha to secure optimum economic operation at all times.

Supply of Catalyst

Use of the process does not obligate refiners to buy Catalyst RD-150 beyond the first year's requirements, although a continuing source of supply can be assured. This freedom from long-term purchase and license agreements is an important consideration when deciding which is the most suitable reforming process.

Low Grade Naphtha Feeds

M. W. Kellogg's unique design permits the effective desulphurization of low grade naphthas as part of the process, and avoids corrosion and metal contamination. Kuwait naphthas thus treated, for example, can produce yields of high octane reformates only slightly lower than those for higher grade Mid-Continent feedstocks.

For More Information

Further details on M. W. Kellogg's catalytic naphtha reforming process, the Sinclair-Baker catalyst, together with some economics of both, are contained in a recent booklet, "Low Cost Production of 95 Octane Clear Reformate." Copy sent on request.

Refinery Process Division

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Do You Know These Words?

By B. H. WEIL
Manager, Information Services
Ethyl Corp. Res. & Engrg. Dept.
Detroit, Mich.

A regular department intended to help administrators and operating men alike keep abreast of technical names and processes in the petrochemical field.

Sulfur

Sulfur, pronounced "**suhl**-fer" and formerly spelled "sulphur," is a chemical familiar to the ancients ("brimstone") and also to the modern petroleum industry.

To the latter it has been chiefly known as the raw material for sulfuric acid, an all-important treating and processing agent, and on the debit side as an element whose various compounds (hydrogen sulfide, mercaptans, organic sulfides, etc.) make natural and refinery gases corrosive and make gasolines ill-smelling, corrosive, and TEL-destructive. Not all are fully aware, however, that these very curses have in the past two decades been frequently turned into profit through economic processes which remove the sulfur in usable form and at the same time produce much more marketable natural gas and petroleum fractions.

Sulfur itself is a yellow solid, heavier than sugar per unit volume, and insoluble in water. It melts at a temperature somewhat above the boiling point of the latter. In addition to being used in the manufacture of sulfuric acid (three-fourths of U. S. sulfur is so employed), it is used in the manufacture of carbon disulfide, in the manufacture of pulp and paper, in the rubber industry (for vulcanizing), in the manufacture of certain synthetic rubbers, etc. Sulfuric acid, in turn, goes into the manufacture of fertilizers, chemicals, paints and pigments, rayon, iron and steel, etc., and is used in petroleum refining.

Sulfur is normally extracted from natural and refinery gases in the form of hydrogen sulfide, which is also the end-product of several gasoline desulfurizing processes. Much of the elementary sulfur produced at recovery plants is used there for the production of sulfuric acid.

During the Korean War, those who installed sulfur-recovery units were able thus to obtain sulfur exempt from consumption restrictions, and to amortize their investments at an accelerated pace. Since the long-term outlook for supplies of sulfur from its other (and much larger) sources is not encouraging, and since demand for sulfur is expected to increase, it seems likely that continued attention will be given to obtaining sulfur from the purification of natural and refinery gases.

Dicumyl Peroxide

Dicumyl peroxide, pronounced "dye-**cue**-mill purr-**ock**-side," is a new petrochemical in which Charles Goodyear would have had quite an interest: it can be used instead of sulfur to vulcanize natural or synthetic rubber (GR-S) to yield products of superior aging characteristics (meaning less tendency for flex cracking or cut growth), better low-temperature serviceability, and of very light color (useful for white sidewalls of tires, etc.).

Dicumyl peroxide has the formula $C_6H_5 \cdot C(CH_3)_2 \cdot O \cdot O \cdot C(CH_3)_2 \cdot C_6H_5$. As its name and formula attest, it is a derivative of cumene (isopropyl benzene), which has the formula $C_6H_5 \cdot CH(CH_3)_2$. It is produced from the latter by an oxidation process (reaction with oxygen) which yields an intermediate, cumene hydroperoxide. The alcohol produced by hydrogenating the latter is then reacted with more cumene hydroperoxide to produce the peroxide. A peroxide, incidentally, has an $\cdot O \cdot O \cdot$ structure.

As mentioned in an earlier item (PETROLEUM PROCESSING, Feb., 1955, p. 234), the raw materials for cumene are benzene and propylene. The first of these is now being extracted in large quantities from catalytic reformates. The latter is recovered from refinery cracked gases or prepared by the dehydrogenation of propane (itself an LPG or LRG).

The future of dicumyl peroxide is not yet assured. Its use in rubber processing is still in the developmental stage, and its higher cost (compared with sulfur vulcanization chemicals) must be reduced before large-scale use can be assured. Higher temperatures are required for the vulcanization process when dicumyl peroxide is used, thus ruling out certain special applications (and rubber processors whose plants are not equipped to operate at such levels). Nevertheless, dicumyl peroxide is one of this year's really interesting petrochemicals.

NEWS in VIEWS . . . in Petrochemicals

LATEST VIEW of Standard of California's multi-million dollar Isophthalic plant nearing completion at Richmond, Calif. Design capacity is 50-million lb/yr.

NEW PILOT PLANT building (right) rounds out facilities at the Cincinnati research center of the U.S. Industrial Chemicals Division of National Distillers Corp.

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Dr. E. O. Hook, formerly with American Cyanamid Co., has joined the research staff of Standard Oil Co. (Ohio) as coordinator of the mobile power lubricants and mobile fuels process sections.

W. S. McClenahan, of the Mellon Institute, has become the coordinator of petrochemicals, industrial products, and basic research sections.

The new administrative supervisor in the chemical and physical research division is **Dr. Harry M. Stine,** who has been with Sohio since 1938.

Supervisor of the mobile power lubricants section is **Dr. S. M. Darling,** who joined the company in 1939. **Dr. Frank Veatch,** a staff member since 1942, has become supervisor of the petrochemical section.

Dr. A. L. Jones, with Sohio since 1946, has been made supervisor of the basic research section. New section leader in mobile power fuels process section is **Dr. H. A. Strecker,** an employee since 1947. And **H. A. Hardman,** who joined the company in 1946, has been promoted to senior research associate in the industrial products section.

A. G. Stewart, formerly superintendent of Imperial Oil Co.'s Winnipeg (Man.) refinery, has become manager of the company's Ioco refinery, near Vancouver, B. C. He succeeds **E. K. Lewis,** recently named manager of the Edmonton (Alta.) refinery.

Col. T. H. Barton, chairman of the board of Lion Oil Co. before its merger with Monsanto Chemical Co., and now on the Monsanto board of directors, has been elected to the finance committee of Monsanto.

The former president of Lion, **T. M. Martin,** is president of the Lion Division and a vice-president of Monsanto.

Jeff Davis, Lion vice-president and general counsel, is an assistant secretary of Monsanto, and **E. W. Atkinson,** Lion vice-president and treasurer, is an assistant treasurer in the Monsanto firm.

Edgar C. Britton, director of the Dow Chemical Co.'s Britton research laboratory, has been given the 1956 Perkin Medal by the American Section of the Society of Chemical Industry.

The award was given to Dr. Britton because of his numerous contributions in the field of industrial organic chemistry. Among them were his work on the synthetic production of phenol, his pioneering role in the commercial development of silicone resins, and his synthesis of eight essential amino acids—among them methionine.

Dr. Britton received his A.B. and Ph.D. degrees from the University of Michigan. He was an instructor in organic chemistry at the school until he joined Dow's organic research staff in 1920. He has been with the company since then, as director of its organic research laboratory from 1932 until 1953, when he was put in charge of the laboratory bearing his name.

He was president of the American Chemical Society in 1952 and belongs to numerous scientific and honorary groups.

D. B. Benedict, formerly works manager of Carbide and Carbon Chemicals Co., has been promoted to vice-president. He is responsible for

Mr. Benedict

Mr. Rowland

Mr. Ross

long range planing in certain research and development activities, as well as all programs on synthetic fibers.

The post of works manager has been filled by **K. H. Rowland,** who became the assistant works manager in 1954.

Harley M. Ross, another former assistant works manager, has been made manager of gas operations.

Benedict took his B.S. and M.S. degrees at the University of Michigan and began with Carbide as a technical assistant at the South Charleston plant in 1933. He became assistant superintendent of chemicals and resins in 1940 and general superintendent of the plant in 1952. He went to New York as assistant works manager in 1953 and was made works manager in June of 1954.

Rowland joined the South Charleston plant as a chemical engineer in 1934, after his graduation from the University of Michigan with a B.S. degree. He became production area supervisor in 1939, chemical production supervisor in 1944, and then was transferred to the Institute plant in 1947, as assistant superintendent. In 1952 he returned to South Charleston as superintendent of chemicals and resins, a year later was made general superintendent of the plant, and was moved to New York in 1954 as assistant works manager.

Ross's first job with the Union Carbide organization was as an engineer with Linde Air Products Co., beginning in 1923. This was after his graduation from the University of Illinois with a B.S. degree in mechanical engineering.

A year later Ross went to Carbide and Carbon Chemical's Clendenin, W. Va., plant, and in 1925 to South Charleston. Here he was assistant superintendent from 1930 until he became superintendent of the Texas City plant in 1941. He was made assistant works manager in 1952.

Dr. Alex G. Oblad, manager of research and development for Houdry Process Corp., has been elected chairman of the American Chemical Society's Division of Petroleum Chemistry for 1955-56. He succeeds **Dr. Everett C. Hughes,** Standard Oil Co. (Ohio).

Chairman for 1956-57 will be **Dr. Sherman S. Shaffer,** staff associate in the refining, technical and research divisions of Humble Oil and Refining Co.

Chosen to represent the division's six geographical areas on the executive committee were: **John S. Ball,** United States Bureau of Mines, Laramie, Wyo.; **Dr. Philip C. White,** Pan American Refining Corp., Texas City, Tex.; **Dr. Robert F. Marschner,** Standard Oil Co. (Ind.), Whiting; **Dr. John W. Brooks,** Socony Mobil Oil Co., Paulsboro, N. J.; **Dr. Leslie C. Beard, Jr.,** also of Socony but in New York; and **Dr. Jerry McAfee,** Gulf Research & Development Co., Pittsburgh, Pa.

Dr. Oblad was with Indiana Standard for five years as a research chemist. He joined Magnolia Petroleum in 1942 and rose to chief of chemical research by 1946, and has been with Houdry since 1947.

T. L. Lenzen and **G. L. Parkhurst** have been appointed to the board of directors of Standard Oil Co. of California. Lenzen had been manager of Standard's Eastern Hemisphere opera-

tions before his appointment as a vice-president in 1952.

Parkhurst, a vice-president since 1949, previously was president of Oronite Chemical Co., a Standard of California chemical marketing subsidiary.

Dallas R. Lamont has been elected to the board of Socony Mobil Oil Co. and put in charge of the research and development program and of the company's laboratories.

William M. Holaday, who has headed Socony's research and development activities since 1944, has been appointed to a new position as coordinator of new product planning, reporting to the director in charge of supply and distribution.

Lamont has been patent counsel since 1931. He took a B.S. degree in electrical engineering at the University of Wisconsin in 1920. He was admitted to the New York State Bar in 1924.

With Socony since 1937, Holaday was first assistant general manager of the laboratories. After wartime service with the Petroleum Administration for War, he returned to Socony in 1944 as director of the laboratories. He holds a B.S. degree in mechanical engineering from Ohio State University, Class of 1925.

Dr. Robert W. Schiessler, associate professor of chemistry at Pennsylvania State University, has joined Socony Mobil Oil Co. research and development laboratories as technical director of the research division. He succeeds **Dr. Frederick L. Matthews,** who has become assistant to the technical director of the laboratories.

Ralph E. Albright has been appointed technical director of the products division, succeeding **George G. S. Snyder,** who has become assistant to the director of the laboratories.

Albright will have as his assistant **Edward A. Martin. Donald P. Heath** has succeeded Albright as supervisor in charge of the fuels section, and **John F. Socolovsky** has taken Mr. Martin's post as supervisor of the automotive section. Socolovsky's position as supervisor of the lubricants section has passed to **Leo W. Manley.**

M. L. Root has been appointed assistant manager of the engineering department at General Petroleum Corp.'s Torrance refinery. His last job was as construction engineer at the Ferndale, Wash., refinery.

Root began with the company in 1928 at the Torrance refinery while it was under construction. In 1946 he was made assistant manager of the engineering department at Vernon and three years later became construction engineer at Torrance.

Emmet N. Britton, Jr., has taken the newly created post of public relations manager for California Oil Co., a Standard Oil of California subsidiary. A former newspaperman, Britton also was news editor in Socal's public relations department from the end of World War II to his recent appointment. His headquarters are at Perth Amboy, N. J.

Mr. Wilson

Mr. Douglass

L. T. Wilson has been appointed manager of Shell Oil Co. of Canada's Montreal East refinery. Wilson comes to this post from Shell's Norco, La., refinery, where he was superintendent.

Wilson started with Shell as a junior inspector in 1933. Since the war, he has been successively senior technologist, assistant manager of the catalytic cracking department, assistant superintendent and superintendent at several Shell refineries.

Wilson's post at Norco has been taken by **R. S. Douglass,** formerly assistant manager of the manufacturing engineering department in Shell's head office.

Douglass joined the company in 1927 at Wood River, Ill. He worked in Houston and St. Louis and in 1937 was made the chief engineer of the Norco refinery. Later he held the same post at the Houston refinery, and in 1946 moved to New York.

Joseph L. Seger has been elected to the board of directors of Esso Research and Engineering Co. He is executive vice president of Carter Oil Company and was former president of Interstate Oil Pipe Line Co.

Recent elections to the executive committee of Esso Research are **Stanley C. Hope,** president of Esso Standard Oil Co. and **Cecil L. Burrill,** chief economist of Standard Oil Company (New Jersey). Both men are also on the Esso Research board of directors.

Arnold F. Kaulakis has succeeded **Dr. George M. Maverick** as manager of employee relations for Esso Research and Engineering Co. Maverick has accepted an appointment as visiting professor of the graduate school of business administration, University of Virginia. In the fall of 1956, after his retirement from Esso, Maverick will become a resident professor, with teaching and administrative responsibilities.

Kaulakis is serving in the post on a one-year rotational training assignment. Kaulakis was graduated from M.I.T. in 1916 and was awarded a doctorate in physical chemistry from the University of Geneva. He joined Jersey Standard in 1923, Esso Research in 1942.

Bill Smith, who was supervising engineer in the process design section, has been made an assistant director of the economics division, with the job of coordinating technical aspects of Esso Research's chemical activities.

He has been replaced in process design by **Ritchie Smith,** who was supervising engineering in the engineering development section. This post has been taken by **Cy Rhys, Jr.,** and his job as assistant supervising engineer given to **Harry Moore.**

Also in engineering development, **Tom Reiter** has assumed the group head position left by **Art Palmer,** now in Arabia.

Howard Yowell, who returned recently from a loan assignment in England, has been appointed an assistant director of the products research division. His last post as head of the motor lubricants and wax section has been assumed by **George Tobias,** who had been a group head in that unit.

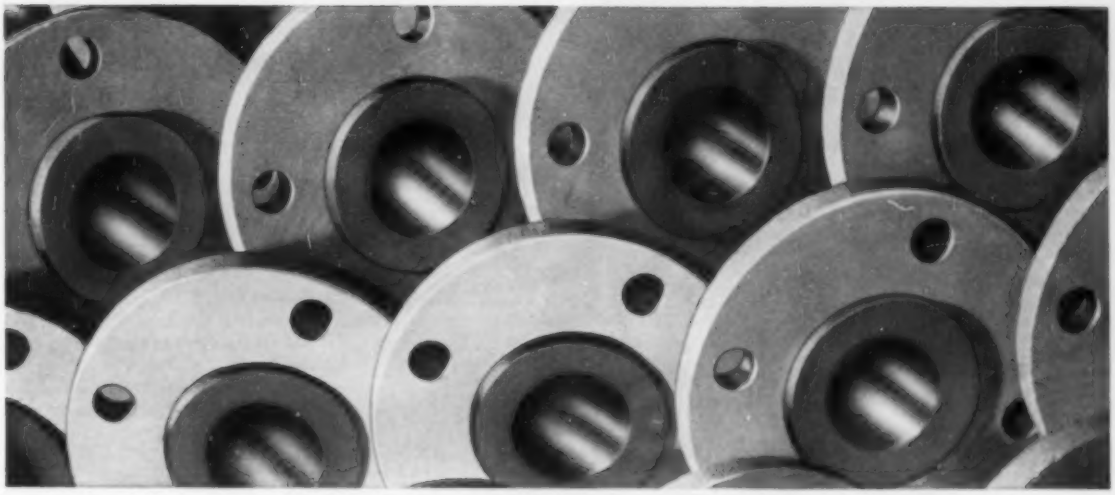
Rotational change at Esso's Bayway refinery has shifted **Selby Harney,** head of the technical department, to the post of assistant general superintendent. He succeeds **Bill Wiseman,** who has replaced **John Wright** as head of the process department. Wright has joined the refinery coordination department of Standard Oil of New Jersey.

Randy Wilkinson, mechanical superintendent, has taken Harney's post and **Bud Bilegow** is the new mechanical superintendent.

R. S. Piroomov has taken over the responsibilities of assistant to the general superintendent. He has been replaced as head of the cracking and light ends division by **Dan Gregg,** who was assistant to the head of the process department.

R. C. Woerner has been promoted to director of the process engineering and design department of Petro-Tex Chemical Corp. He is in charge of

DOW



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Now you can convey chemicals and many other corrosive liquids without worrying about costly shutdowns due to corrosion. For saran lined pipe, fittings and valves are corrosion-resistant . . . form snug, leakproof joints . . . which won't burst up to 150 pounds working pressure.

They're easily and inexpensively installed because they can be cut and threaded in the field with any standard pipe fitter's tools. Their rigidity means that few supporting members are needed.

Saran lined pipe, fittings and valves have a proved record in industry of bringing long trouble-free service. If your operation requires superior resistance to most chemicals and solvents, be sure to investigate saran lined pipe. Contact the Saran Lined Pipe Company, 2415 Burdette Avenue, Ferndale 20, Michigan, Department SP527F-1.

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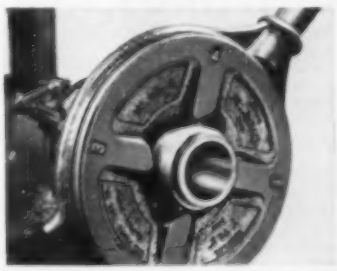
Saran Lined Pipe Can Be Fabricated Right in the Field!

An adapted Beaver Cutter cuts away the end of the steel pipe so that 1/8" of the saran lining is extended. This assures a tight seal after a flange is applied and connected with another flange.



A ratchet type thread cutter makes the standard threads after the Beaver Cutter has been used. A flange or union fitting is attached and tightened until the liner is flush with the fitting.

If two flanges, or a union fitting, are used to make a pipe connection then a full gasket is required. If a flange is made up against a flange fitting or spacer then a half gasket is required.

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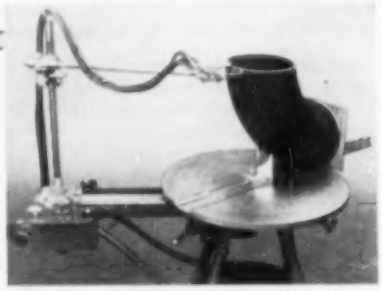

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Use this new precision "Universal" Flame Cutter for re-working, reconditioning and salvaging all types of new and used welding ells, tees, flanges, reducers, etc. Makes extremely clean cuts... no cleaning or hand fitting required. Adjustable degree plate permits fitting to be cut at any angle. Has unitized control panel and unitized gas control valve.

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THE NEW VERNON Write for Bulletin FC-2

"*Universal*" FLAME CUTTER

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work aimed at increasing output and efficiency in the company's Houston butadiene plant.

His former post of general superintendent has been taken by **Dilmas V. Fritz,** who was assistant general superintendent.

H. A. Harrison has been promoted from process superintendent to production superintendent. He will also perform the duties of assistant general superintendent.

Succeeding Harrison is **C. Herbert Sloan,** formerly administrative assistant.

The new administrative assistant is **Walter A. Myrick III,** who was a senior chemical engineer.

Ray I. Potter has left Standard Oil Co. (Ohio), where he worked since 1933, for a position with the Ford Motor Co. engineering staff.

Mr. Potter

From Case Institute of Technology, which graduated him in 1933, Potter went to Sohio and worked until 1938 as a sales engineer.

From 1938 to 1944 he was a product engineer in charge of the product development department, and until 1954 he worked as chief of the fuels and lubricants service division in the manufacturing department. His last assignment with the company was as automotive consultant to the engineering manager on fuels, lubricants and vehicles. Potter was active on committees of the Coordinating Research Council over several years.

D. J. Stark has been named plant manager for the Escambia Bay Chemical Corp. plant now under construction at Pensacola, Fla. From 1951 until joining Escambia Stark was manager of the Tuscola, Ill., plant of National Petrochemicals Corp. Before that he was chief technologist and department manager of catalytic cracking for Shell Oil at Montreal.

William L. Loving has been elected vice-president and manager of the carbon black division of Cabot Carbon Co., a subsidiary of Godfrey L. Cabot, Inc. Loving, who was inadvertently omitted from the November issue of PETROLEUM PROCESSING, was promoted to executive assistant to the general manager of the carbon black department in 1954.

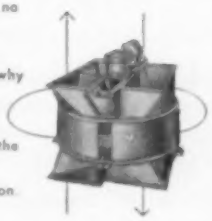
reduce slag

stay on stream at top capacity months longer with the Ljungstrom® Air Preheater

HOW FAST IS "WRITE OFF"?

By cutting turnaround time alone, the Ljungstrom means major savings for you. When you take the other Ljungstrom advantages into account—up to 20% fuel saving . . . more economical furnace design, with no need for convection surfaces . . . burns many fuels you used to throw away . . . consistently higher through-put . . . higher product quality—you can see why a Ljungstrom is paid out in just a few months.

For more complete details on what the Ljungstrom Air Preheater can do for you . . . for an analysis of the heat recovery benefits attainable in fuel burning equipment—call or write The Air Preheater Corporation.



Wherever You Burn Fuel, You Need Ljungstrom

The Ljungstrom operates on the continuous regenerative counterflow principle. The heat transfer surfaces in the rotor act as heat accumulators. As the rotor revolves, the heat is transferred from the waste gases to the incoming cold air.

Slag—primary cause of reduced capacity—can be substantially reduced by the Ljungstrom Air Preheater.

That's because preheated air mixes more thoroughly with fuel. The result is better combustion . . . and less slag-forming material present in the furnace. Oil tubes stay cleaner . . . stills stay on stream at top capacity for months longer. As an example, one pipe still in an eastern refinery dropped from 16,000 barrels a day to 12,000 because of slag. Now, with a Ljungstrom and modern high-temperature burners, the still operates continuously at 18,000/20,000 barrels.

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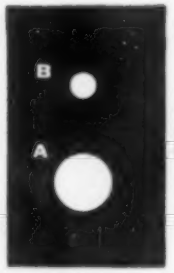
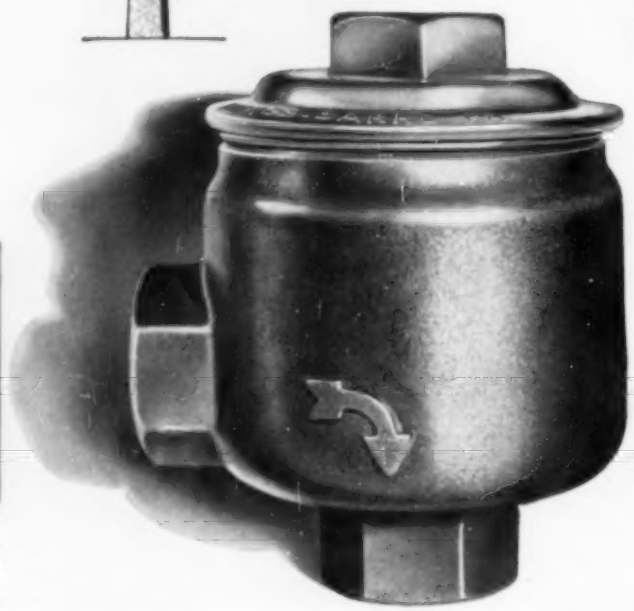
TALK ABOUT

Capacity



Discharge orifice of 1" NICHOLSON trap (A) compared with other types of same size (B). Nicholson's greater—in every size!



Compare capacity of a Nicholson Steam Trap with any other trap of same size. Greater capacity—right across the board—means Nicholson Industrial Traps discharge condensate and air from steam lines and process equipment *faster*, more *effectively*. In toughest petroleum processing service, Nicholson's pay off 4 ways:

- **lower initial cost—more for the money**
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Where performance counts, specify Nicholson. Write for *Catalog 953*.

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The Houdriflow catalytic cracker of the Gewerkschaft Erdöl-Raffinerie Emsland, at Lingen, Germany, is the principal unit in a completely new refinery. This 17,500 BPSD cracker went on stream in the Fall of 1953.

The Emsland Houdriflow cracks straight run and coker gas oils and, in addition, desulphurizes the straight run and coker gasoline simultaneously. No crude distillation unit exists at this refinery; the Houdriflow feed stock comprises all flashed straight run materials from the crude as well as total coker effluent—gas, gasoline and gas oil. This arrangement eliminates intermediate storage equipment and reduces operating costs.

For a new brochure describing the Houdriflow process, write: Houdry Process Corporation, 1528 Walnut Street, Philadelphia 2, Pennsylvania.

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Pioneer in Catalytic Processes

How much can you save by reducing downtime from fouled heated exchangers?

Du Pont FOA-2 can help you do the job!

Fouled heat exchangers are one of the most common causes of refinery downtime and production loss. But now, you can easily reduce many heat exchanger fouling problems with a small amount of Du Pont FOA-2. For example...

Case history

A major refinery was processing straight-run stock containing about 20% coker distillate. The initial product at 230°F. was flowing through the shell side of the heat exchanger to the pre-heater. The product at 655°F. returned to the hot receiver through the tubes.

Fouling on the shell side of the heat exchanger was so severe that it forced shutdowns every two or three days.

Du Pont FOA-2 was tried... added just prior to the heat exchangers in concentrations of 20 pounds per 1,000 barrels.

At last report, the heat exchangers had been on stream for over two months without a forced shutdown. Before the additive was used, it was not unusual to get a loss in heat transfer coefficient of as much as 10 units per day. After FOA-2 was added, there has been essentially no change in heat transfer coefficient.

Other uses

Du Pont FOA-2 can also be used as a stabilizer and sludge dispersant for diesel and heating oils. In some cases, it has demonstrated effective corrosion inhibition, too. And it can be used in combination with Du Pont Metal Deactivator which guards against metal contamination.

Whatever your processing set-up, the chances are good that Du Pont FOA-2 can help to reduce substantially your heat exchanger cleaning problems. Why not talk it over with one of our Petroleum Chemicals Division representatives. You will find him qualified to recommend the dosage and point of addition best suited to your individual needs. And you can easily get in touch with him at one of our sales offices listed below.

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By Peter J. Gaylor, Patent Attorney, Elizabeth, N. J.

Partial Hydrogenation Lowers Coking Of Aromatic Cat Cracker Feed Stocks

IT HAS been recognized for some time that hydrocarbons rich in aromatic constituents are less desirable feed stocks for cracking, particularly catalytic cracking, than strongly paraffinic or naphthenic feed stocks. For a given yield or conversion into gasoline, cracking of aromatic oils produces more coke and gas than cracking of non-aromatic oils. High coke formation or a low gasoline-to-coke production ratio is particularly harmful in catalytic cracking since the coke formed is deposited on the catalyst and must be removed by combustion to maintain the catalyst active. Coke formation is, therefore, the most important single factor limiting the capacity of catalytic cracking plants.

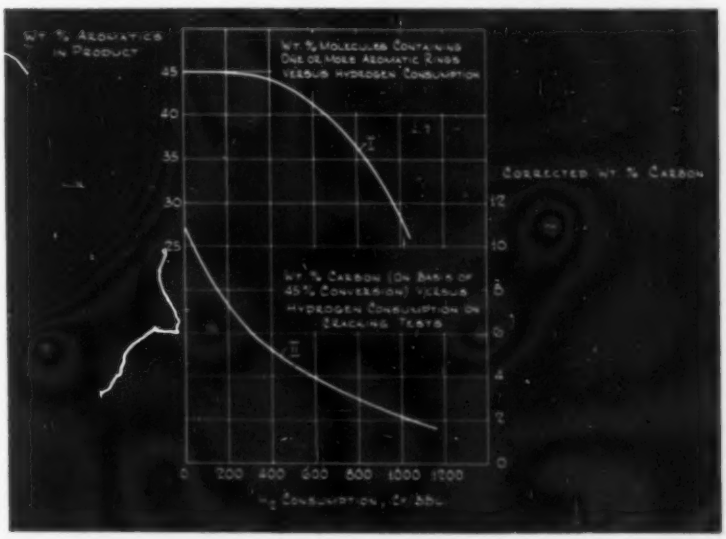
U.S. Patent No. 2,632,727, issued to Esso Research & Engineering Co., discloses a process of improving cracking feed stocks by total removal of aromatics. There, the strong carbon-forming tendency of highly condensed aromatics is emphasized.

In the more recent Patent No.2,717,-864, issued to the same company, it is pointed out that the utility of aromatic hydrocarbons as cracking feed stocks, with respect to the gasoline-to-coke production ratio, decreases as the degree of ring condensation of the aromatic molecule increases. More specifically, it was found that single ring aromatics, such as benzene and its homologs, are of about the same quality with respect to the gasoline-to-carbon production ratio as are paraffinic and naphthenic cracking feed stocks, while condensed ring aromatics containing four or more carbon rings per molecule are extremely strong carbon formers. Aromatics containing two and three condensed rings per molecule are of intermediate quality and may be tolerated in the cracking feed in relatively high concentrations without danger of an excessive reduction of the gasoline-to-carbon production ratio.

On the basis of this discovery, the patent provides for the selective removal, from aromatic-type cracking feed stocks, of condensed-ring aromatic compounds containing four or more condensed carbon rings per molecule while leaving less highly condensed aromatics intact. This selective removal may be effected by solvent extraction but, because of poor selectivity, such an operation is undesirable. Better results are obtained either with alumina gel adsorption or by partial hydrogenation. The latter is accomplished with Group 6 or Group 8 catalysts at a total pressure of 500-3000 psig., and a temperature of 100°-1000°F.

In the hydrogenation of aromatic feed stocks, hydrogen is preferentially consumed by at least partial hydrogenation of the most highly condensed aromatic ring structures. This result is illustrated by curve 1 in the illustration, in which wt.-% aromatics (defined as molecules containing one or more aromatic rings) is plotted against hydrogen consumption. It will be seen that "wt.-% aromatic," i.e. total aromatics, is not reduced appreciably until relatively high hydrogen consumption (about 600 cu. ft./bbl.) is reached. This means that the more highly condensed ring structures must have been partially hydrogenated first, resulting in a reduction of the degree of their condensation.

Curve 2 correlates carbon formation upon catalytic cracking on the basis of equal conversion (45%) with hydrogen consumption in the hydrogenating pretreatment. It will be seen that the rate of reduction of carbon formation (downward slope of curve 2) is substantially greater within the range of low H_2 consumption (about 600 cu. ft./bbl.) than at higher H_2 consumptions. It follows that the highest rate of carbon make reduction (as shown in curve 2) coincides with the preferential hydrogenation of the most highly condensed aromatics (as shown in curve 1), and that the selective hydrogenation of these highly condensed aromatics from catalytic cracking feed stocks affords substantial advantages.



IN PARTIAL HYDROGENATION of cat cracker feed stock, the wt.-% of aromatic molecules drops significantly only at high levels of H_2 consumption (Line 1). But it's at lower levels that sharpest drop occurs in carbon formation when the stock is cracked (Line 2), because H_2 attacks the worst coke-makers—multi-ring aromatics—first.

How to Cut Polymerization Of Olefins in Alkylation

POLYMERIZATION of olefins is a degradation reaction that is avoided as much as possible in alkylation. One way is to inhibit this polymerization and other side reactions by avoiding intimate contact of the olefins with the catalyst when there are no isoparaffins present. This has been done by providing a substantial excess of isoparaffins in the reaction zone or by diluting the olefin with a material containing an excess of isoparaffins before sending it to the reaction zone.

Such expedients, however, don't completely eliminate the polymerization of olefins in emulsion alkylation. Since the emulsion separation step requires some time, olefins will polymerize and sludges form in both the separation zone and in the lines re-

cycling the acid phase to the reaction zone. This means that polymers of comparatively low octane number find their way into the alkylate and, since the sludge remains in the acid, acid consumption is increased.

In U.S. Patent No. 2,717,913, Esso Research & Engineering Co. describes a system for separating the emulsion from the alkylation process so that polymerization and other side reactions are reduced to a minimum, claiming an improvement in yield and quality of product.

The portion of the acid-hydrocarbon emulsion withdrawn from the alkylation reaction zone for product recovery is continuously charged to a separation zone. The resolution of the emulsion in the separation zone creates a top hydrocarbon layer including alkylate reaction products and unreacted isoparaffins and a bottom acid layer containing dissolved olefins. A portion of this top, hydrocarbon layer is continuously dispersed in the acid layer. The remaining hydrocarbon is set to product recovery operations. Acid is continuously withdrawn from the acid layer and returned to the reaction zone.

The continuous introduction of a portion of the hydrocarbon product stream into the acid layer insures that excess isoparaffins will be in the acid layer at all times. This promotes alkylation of the dissolved olefins and minimizes olefin polymerization and other degradation reactions. Spraying hydrocarbons into the settled acid causes some turbulence in the intermediate emulsion phase, promotes emulsion resolution and decreases retention time in the reaction zone. By injecting separated hydrocarbon, rather than an extraneous isoparaffin stream, into the acid phase, the material balance in the entire system is not upset, and the net load on product recovery equipment is not increased.

Patents Issued in October

This listing gives the patent number, patentee or assignee, and a description of all patents of interest to the petroleum processing industries in the Official Gazette of the U. S. Patent Office for Oct. 4, 11, 18, and 25, 1955, Vol. 699, Nos. 1-4.

PROCESSES

Conversions

2,719,873 (Phillips Petroleum Co.) Means and method for converting hydrocarbons using pebble heat exchange chamber.
2,720,550 (Trustees of Iowa College) Dehydrogenation of naphthenes by means of sulfur dioxide.
2,721,118 (Societe Anonyme dite Compagnie) Apparatus for maintaining a constant fluidized bed level.
2,721,167 (Esso Research & Engineering Co.) Catalytic fluid hydroforming employing inert heat transfer solids.
2,721,168 (Esso Research & Engineering Co.) Seed coke production in fluid coking systems using oxidation to increase friability.
2,721,225 (Esso Research & Engineering Co.) Catalytic production of cyclo-olefins from naphthenes.
2,721,226 (Atlantic Refining Co.) Conversion of aromatic hydrocarbons into alkyl cycloparaffins.
2,721,884 (Shell Development Co.) Production of aromatic hydrocarbons from naphthenes, using Pt catalyst.
2,721,885 (Universal Oil Products Co.) Condensation of aromatic compounds with unsaturated organic compounds in the presence of composite catalysts.
2,721,886 (Universal Oil Products Co.) Catalyzed condensation of aromatic compounds with unsaturated organic compounds.
2,721,887 (Universal Oil Products Co.) Condensation of aromatic compounds with unsaturated organic compounds in the presence of composite catalysts.
2,721,889 (Esso Research & Engineering Co.) Phosphoric acid olefin polymerization process.

Refining

2,719,816 (Esso Research & Engineering Co.) Light ends recovery in fluid hydroforming.
2,719,817 (Shell Development Co.) Process of dewaxing oils in inert flotation gas.
2,719,818 (Phillips Petroleum Co.) Means and method for converting hydrocarbons with the use of heated pebbles.
2,719,819 (Institute of Gas Technology) Apparatus and method for recovery of dry oil gas tar.
2,720,447 (Universal Oil Products Co.) Contacting apparatus.
2,721,164 (Esso Research & Engineering Co.) Ammonia extraction process for mineral oils.
2,721,165 (Standard Oil Co.-Ohio) Control of wax deoiling.
2,721,166 (Esso Research & Engineering Co.) Treatment of sour distillates with hypochlorite solution.
2,721,205 (Stanolind Oil & Gas Co.) Caustic refining of hydrocarbon-chemical stream containing organic acids and metal contaminants.
2,721,735 (Shell Development Co.) Tubular heater with partial flue gas recirculation and heating method.
2,721,790 (Shell Development Co.) Liquid contacting method and apparatus using coalescers.
2,721,829 (Shell Development Co.) Dewaxing mineral oils.
2,721,831 (Esso Research & Engineering Co.) Stabilization of catalytically cracked gasoline, using cupric reagent.
2,721,832 (Esso Research & Engineering Co.) Contacting gasoline fractions with activated carbon to remove di but not mono olefins.
2,721,833 (Calif. Research Corp.) Process for acid treating and neutralizing naphthenic lubricating oil stocks, using coalescing electrical field.
2,721,888 (Wulff Process Co.) Process for removing undesired tars from a cracked gas.

PRODUCTS

Chemicals

2,719,425 (Karl Torsten Kalle) Gas analysis apparatus.
2,719,601 (Badische Anilin & Soda-Fabrik) Separation of acetylene from dilute mixtures.
2,719,822 (Universal Oil Products Co.) Production of electrolytic chlorine from hydrogen chloride, using methyl chloride solvent.
2,719,853 (Atlantic Refining Co.) Production of dicarboxylic acid anhydrides.
2,719,858 (Ethyl Corp.) High molecular weight alcohols by reducing sugar cane oil.
2,719,860 (Shell Development Co.) Sulfur-containing esters of silicon acids.
2,719,868 (C. H. Boehringer Sohn) Process for the production of a chlorination product of dicyclopentadiene.
2,719,872 (John Happels & Charles J. Marsel) Cracking of tertiary aliphatic hydroxy compounds to produce acetylenic hydrocarbons.
2,720,497 (Phillips Petroleum Co.) Condensation products from alkene oxides with polycyclic alcohols and hydroxylated polycyclic aldehydes.
2,720,509 (Phillips Petroleum Co.) Sulfur containing resins from 4-vinyl-1-cyclohexene.
2,720,510 (Phillips Petroleum Co.) Procedure for manufacture of synthetic rubber.
2,720,537 (Universal Oil Products Co.) Separation of mahogany acids according to molecular weight.
2,720,539 (Sun Oil Co.) Refining naphthenic acids.
2,720,547 (Standard Oil Co.-Ind.) Preparation of ethers.
2,721,136 (Gulf Oil Corp.) Process for demetalling hydroformylation stage products.
2,721,170 (Sinclair Refining Co.) Extractive distillation of o-xylenes from a petroleum fraction.
2,721,176 (Gulf Oil Corp.) Resinous products (aldehyde condensation).
2,721,180 (Kendall Refining Co.) Organo-boron compositions and method for production thereof.
2,721,185 (Phillips Petroleum Co.) Vulcanized liquid polymers as rubber plasticizers.
2,721,188 (Union Oil Company of Calif.) Alpha-hydroxy acids and estolides and their derivatives.
2,721,190 (Union Oil Co. of Calif.) Production and separation of polycarboxylic acids.
2,721,222 (Esso Research & Engineering Co.) Separation of ethers.
2,721,223 (Esso Research & Engineering Co.) Hydrogenolysis of substituted meta dioxanes.
2,721,227 (Stanolind Oil & Gas Co.) Method and apparatus for making acetylene.
2,721,851 (Phillips Petroleum Co.) Thermally stable polysulfone resins.
2,721,862. (Pure Oil Co.) Sulfurized turpenes and three step process for making same utilizing sulfurization promoters.
2,721,874 (Stanolind Oil & Gas Co.) Purification of alcohols.
2,721,875 (Socony Mobil Oil Co.) Method for preparing aminomethyl-sulfonic acids.
2,721,878 (Esso Research & Engineering Co.) Strong acid as a polymerization modifier in the production of liquid polymers.
2,721,879 (Esso Research & Engineering Co.) Aldehydes as polymerization modifiers in the production of liquid polymers.
2,721,882 (Universal Oil Products Co.) Halobicycloalkenyl aryl ethers and method of preparation thereof.

Catalysts

2,719,829 (W. R. Grace & Co.) Preparation of silica-alumina catalysts from feldspars.
2,720,492 (Ansul Chemical Co.) Activated alumina free of fines.
2,721,184 (Esso Research & Engineering Co.) Process for preparing activated carbon.

Fuels

2,720,313 (Garret Corp.) Engine fuel purification system (centrifugal).
2,720,448 (Du Pont Co.) Motor fuels containing TEL and borinate ester.
2,720,449 (Du Pont Co.) Motor fuels containing TEL and boronate ester.
2,721,121 (Kendall Refining Co.) Fuel containing organo-boron composition.
2,721,122-3 (Institute of Gas Technology) Thermal method of making oil gas interchangeable with natural gas.
2,721,169 (Esso Research & Engineering Co.) Desulfurization of fluid coke with oxygen and hydrogen.
2,721,792 (Borg-Warner Corp.) Nitro-paraffin propellant.

Lubricants

2,719,826 (California Research Corp.) Aluminum soap grease compositions.
2,719,827 (California Research Corp.) Lubricating oil compositions containing sulfur corrosive to silver.
2,720,491 (Standard Oil Co.-Ind.) Extreme pressure lubricant containing complex double soap.
2,721,177-8 (California Research Corp.) Oxyalkylene glycol lubricant composition.
2,721,179 (Socony Mobil Oil Co.) Thienylthio-substituted aldehydes and ketones and mineral oils containing the same.
2,721,181 (Kendall Refining Co.) Lubricant containing organo-boron compound
2,721,843 (Monsanto Chemical Co.) Organo-metal complexes and lubricating oils containing them.
2,721,844 (The Texas Co.) Lithium soap-synthetic base instrument grease.
2,721,845 (The Texas Co.) Metal soap grease containing alkaline earth metal alkyl phenol sulfide.
2,721,877 (Esso Research & Engineering Co.) Lubricating oil additives copolymers and a process for their preparation.

Specialties

2,719,779 (Godfrey L. Cabot, Inc.) Process of making hard carbon black pellets.
2,719,824-5 (Pennsylvania Salt Mfg. Co.) Lubricating composition for coating blank metal stock.
2,720,466 (Standard Oil Co.-Ind.) Asphalt compositions containing wax and pour inhibitor.
2,720,480 (Ethyl Corp.) Fungicidal compositions and method of using same.
2,721,146 (Standard Oil Co.-Ohio) Bituminous covering material and method of making.
2,721,183 (Genesee Research Corp.) Dibasic alkali metal arsenate and alkali tetraborate mixture as corrosion inhibitor for aqueous glycol composition.

2,721,830 (Esso Research & Engineering Co.) Novel oxidized asphalt process and composition.
2,721,846 (The Texas Co.) Flushing oil composition.
2,721,804 (Universal Oil Products Co.) Stabilization of fatty materials.

Miscellaneous

2,719,780 (Standard Oil Co.-Ohio) Fume control apparatus.
2,720,280 (Consolidated Mining & Smelting Co.) Method of treating gases by scrubbing.
2,720,450 (United Gas Improvement Co.) Cyclic process and apparatus for manufacturing gas rich in hydrogen and carbon monoxide, by burning fuel.
2,720,782 (Carter Carburetor Corp.) Instrument for testing fuel pumps.
2,720,784 (William D. Kelly) Liquid level indicating means.
2,720,939 (Godfrey L. Cabot Inc.) Process for recovering aerosol solids.
2,721,175 (Esso Research & Engineering Co.) Method of preventing corrosion of corrosive fluid to ferrous metals, by treating with urea.
2,721,578 (Phillips Petroleum Co.) Multistream rotary selector valve.
2,721,696 (Stanolind Oil & Gas Co.) Phase equilibriam computer.
2,721,943 (Texaco Development Corp.) Radiation detections.

EQUIPMENT

Processing, general

2,719,354 (A/B Svenska Maskinverken) Method of making extended surface heat exchangers.
2,719,780 (Standard Oil Co.-Ohio) Fume control apparatus.
2,719,818 (Phillips Petroleum Co.) Pebble-heater.
2,719,819 (Institute of Gas Technology) Apparatus and method for recovery or dry oil and gas tar.
2,719,873 (Phillips Petroleum Co.) Pebble-heater.
2,720,220 (Jean Louis Gratzmuller) Gas-liquid accumulators.
2,720,383 (Andre Huet) Heat exchanger tubes.
2,720,389 (Air Products Inc.) Fractionating columns.
2,720,447 (Universal Oil Products Co.) Contacting apparatus.
2,720,450 (United Gas Improvement Co.) Process and apparatus for manufacturing gas rich in hydrogen.
2,721,061 (Halsey W. Taylor Co.) Heat exchanger for cooling liquids.
2,721,118 (Societe Anonyme dite Compagnie pour la Fabrication des Compteurs et Materiel d'Usines a Gaz) Apparatus for maintaining a constant fluidized bed level.
2,721,227 (Stanolind Oil & Gas Co.) Method and apparatus for making acetylene.
2,721,621 (Loy A. Hall) Gas and oil separating apparatus.
2,721,730 (Societe le Carbone-Lorraine) Heat exchanger.
2,721,735 (Shell Development Co.) Tubular heater with partial flue gas recirculation and heating method.
2,721,789 (Gerald C. Gill) Hydrogen generator.
2,721,790 (Shell Development Co.) Liquid contacting method and apparatus using coalescers.

Instruments

Re 24,075 (Liquidometer Corp.) Liquid gravity and weight gage.
2,719,425 (Karl T. Kalle) Gas analysis apparatus.
2,719,431 (Pressure Gauges Ltd.) Vacuum gages.
2,719,889 (Hays Mfg. Co.) Fluid flow responsive device.
2,720,108 (Johnson-Williams Inc.) Gas analysis apparatus.
2,720,113 (Statham Labs. Inc.) Pressure gages.
2,720,115 (Sperry Rand Corp.) Condenser level.
2,720,216 (Scully Signal Co.) Fitting for carrying signalling and gaging units.
2,720,594 (Phillips Petroleum Co.) Multi-component infrared analyzer.
2,720,785 (American Steel Foundries) Liquid-level indicator.
2,720,786 (William S. Sawle, Jr.) Heat indicator of the pyrometer thermocouple type.
2,720,787 (Sydney Smith & Sons Ltd.) Multirange pressure gage.
2,721,478 (General Motors Corp.) Mass reaction flow-meter.
2,721,480 (Weston Electrical Instrument Co.) Temperature-measuring apparatus.
2,721,481 (Kenneth D. Rainsberg) Gravity meter.

Pumps & Compressors

2,720,841 (Weil Pump Co.) Submersible sump pump.
2,720,842 (Joseph Lucas Ltd.) Pump.
2,721,025 (National Research Corp.) High vacuum pump.
2,721,026 (General Electric Co.) Blade seal for rotary pumps.
2,721,677 (Bernard Bercovitz) Electric motor-driven pumps.

Valves & Fittings

2,719,518 (Lyman B. Newman) Automatic valve.
2,719,531 (Minneapolis-Honeywell Regulator Co.) Safety valve.
2,719,532 (Specialties Development Corp.) Valve.
2,719,536 (Crane Co.) Cross-flow prevention device.
2,719,537 (Selas Corp. of America) Flow regulating device.
2,719,538 (Raymond Cole and John Gilder) Self-closing valve device.
2,719,675 (Cash Valve Mfg. Corp.) Dip tube type automatic reseating pressure and temperature relief valve.
2,720,214 (Bastian-Blessing Co.) Relief valve manifold.
2,720,219 (Grove Valve and Regulator Co.) Fluid-flow valve.
2,720,379 (John L. Williams) Stock valve.
2,720,887 (New York Air Brake Co.) Pressure reducing valve with over-pressure relief.
2,720,888 (Sun Oil Co.) Reversed pressure actuated vent valve.
2,720,891 (National Tank Co.) Diaphragm valves.
2,725,543 (Frank W. Johnson) Self-adjusting contactor for valves.
2,721,571 (U.S.A.) Shut-off valve.
2,721,575 (Francis Gier and Frank Tagliaferri) Automatic vacuum and pressure release valve.
2,721,576 (Grove Valve and Regulator Co.) Fluid pressure regulator.
2,721,722 (Ernest C. Saftig) Plug valve.

Miscellaneous

2,720,390 (Sun Oil Co.) Apparatus for preparing salt cavities by solution.
2,720,893 (Cleaner Pipelines Co.) Temporary expansion plug for pipe lines, etc.
2,720,909 (N. Erlanger, Blumgart & Co.) Heat insulating material.
2,721,581 (Dresser Industries, Inc.) Pipe repair sleeve.
2,721,582 (Dresser Industries, Inc.) Pipe clamp.

Processing of Patents Shifts Into High Gear

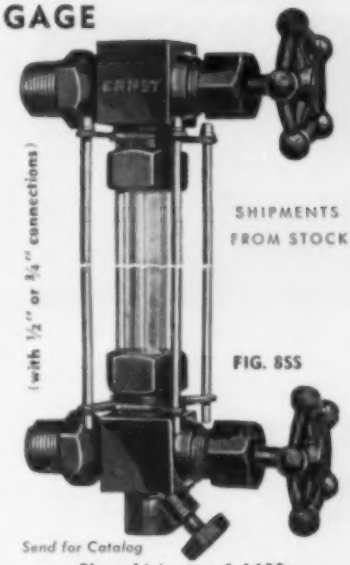
The U. S. Patent Office has embarked on a speed-up program intended to cut the processing time for new patents in half, according to *Chemical Week* (Nov. 6, 1955, p. 44), a McGraw-Hill magazine. Formerly, applicants had to wait from 36 to 48 months before patents were finally allowed. To cut this interval in half, the Patent Office has (1) taken another day's work from its present examiners, (2) improved its priority system, and (3) obtained more money so as to enlarge the staff of examiners by almost 50% over last June's complement.

The backlog of patents is being attacked by the Saturday efforts of 300 examiners. January's allowed patents are expected to number about 700 (compared with 296 in Jan., 1955) as a result.

The priority system now applying to limited categories of patents has been expanded to include every patent already acted on two or more times by an examiner. Priority patents are not handled in strict numerical order, as are all others.

For the current fiscal year, Congress gave the Office a raise of $2 million over the fiscal 1955. Another $2 million may be added next year. This money is being used to hire and train 300 additional examiners.

ERNST
STAINLESS STEEL
GAGE



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LIVINGSTON, N. J.

ENGINEERS

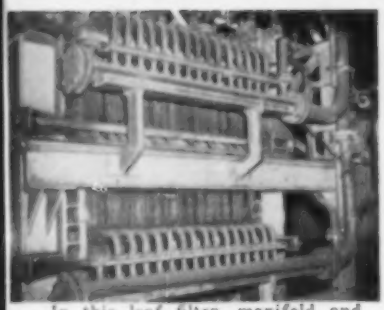
Chemical, Mechanical or Oil Refining

Company has several openings for engineers, with 2 to 8 years experience in design and or operation of processing equipment, for process design position leading to sales.

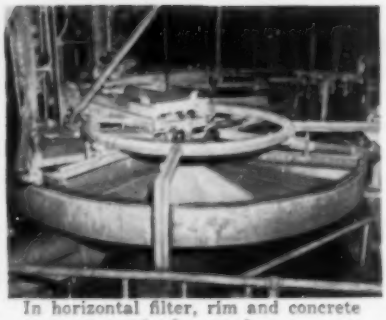
Salary, bonus and excellent working conditions.

P8284 Petroleum Processing
330 W. 42 St., New York 36, N. Y.

"We rely on lead at every stage of acid handling" says large chemical processor



In this leaf filter, manifold and plates are lead



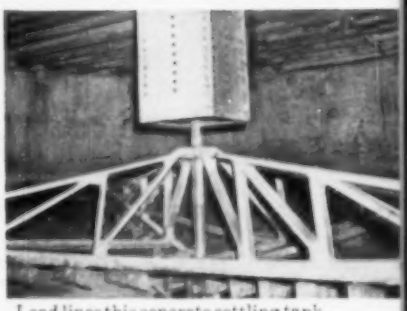
In horizontal filter, rim and concrete supports are lead-covered

In clarification rotaries, lead protects parts exposed to acid

"...in our filters

Lead apron 24" high guards digester rim against spill

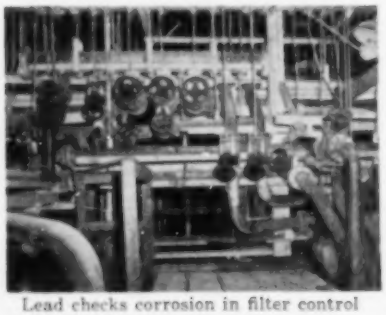
Lead lining protects interior of this steel digest tank



Lead lines this concrete settling tank, covers rake. Plows are solid lead

"...in our tanks

Lead-lined valves and piping serve digesters



Lead checks corrosion in filter control valve station

Lead stacks and flues withstand corrosive fumes.

"...in our lines...valves and pumps...and flues"

Lead's cost is low...its maintenance economical...its salvage value high

National Lead is a leading supplier of lead equipment for handling sulphuric acid solutions. If you have an acid control problem, we will be glad to help you solve it.

National Lead Company

111 Broadway, New York 6, New York

CEC Alters Name, Absorbs CVC

Consolidated Engineering Corp. has changed its name to Consolidated Electrodynamics Corp., after stockholder approval in November. The change was voted because, according to the company, the word "engineering" does not adequately describe the company's scope of business, which includes manufacture and sale of electronic instruments, and certain states actually will not approve of the company's operation with its current name.

In an organizational change, Consolidated Vacuum Corp., a wholly owned subsidiary, was merged into the parent company, to function as the ConVac Division of Consolidated. No change in policies, management or personnel is planned for ConVac.

FOR OIL RESEARCH, Universal Oil Products new facility at Des Plaines, Ill., provides 60,000 sq. ft. of floor space broken into one-room labs with adjoining offices. Basement holds a completely self-sufficient bomb shelter-meeting room.

New Tenamene Stocks in Canada

Warehouse stocks of "Tenamene," a group of gasoline additives supplied by Eastman Chemical Products, are now being maintained in Canada for customers in Quebec and southeastern Ontario.

Stocks are located at Continental Warehouse & Transfer Ltd., 2195 Masson St., Montreal, and at Intercontinental Warehouses Ltd., Bethridge Rd., Rexdale, Toronto.

Shipments from the Canadian stocks will be quoted in terms of Canadian dollars. Truckload and smaller shipments to eastern Canadian refineries will continue to be made from Kingsport, Tenn.

Rockwell Builds in West

A warehouse, assembly and repair plant will be constructed by Rockwell Manufacturing Co. at Porterville, Calif., early in 1956. The structure will provide 100,000 sq. ft. of space and will cost about $1,000,000. It will be used for Rockwell meter and valve products for West Coast distribution, also for warehousing of Rockwell-built Delta power tools.

Porterville is located about 160 miles north of Los Angeles and is served by the Southern Pacific and Santa Fe Railroads.

Girdler to Make AMF Mixers

A licensing agreement between the Girdler Co. and the American Machine & Foundry Co. makes Girdler exclusive manufacturer and marketer of the A.M.F. continuous mixer and the A.M.F. continuous disc blender. This will complement Girdler's Votator processing apparatus, widely used in chemical and petroleum processing, as well as in the food and textile industries.

The mixer and disc blender are used together in continuous wet and dry processing operations.

Mr. Turner

Dr. Kirby

Dr. Hafstad

Mr. Sergeys

Ethyl Promotes, Adds Director

The new post of executive vice-president at the Ethyl Corp. has been filled by B. Bynum Turner, formerly vice-president of research and engineering. He has been succeeded by Dr. George F. Kirby, who was general manager of engineering and research at Baton Rouge.

A new member of the board of directors is Dr. Lawrence R. Hafstad, an atomic energy scientist and a vice-president of General Motors Corp. He replaces Charles L. McCuen, who retired this year as an Ethyl director, vice-president of General Motors and general manager of the Research Laboratories Division.

Francis J. Sergeys, director of the chemical engineering division, has been promoted to general manager of research and engineering operations at Baton Rouge and Houston, to succeed Dr. Kirby.

Dr. Paul A. McKim, assistant director of process development, has taken Mr. Sergeys former post.

New Houston Lab for Ethyl

A gasoline testing laboratory has been opened in Houston by the Ethyl Corp. It offers measurement of gasoline characteristics on a "same day" basis, and is located at 3910 W. Alabama. The location will also house Ethyl's Houston district office, where all the company's field services will be coordinated.

Fluor Forms Canadian Affiliate

Fluor Corp. has formed the Prairie Pipe Co., Regina, Sask., to make steel pipe for the oil and gas industries of Canada. Prairie Pipe's factory is now under construction at a 110-acre site outside Regina. Completion of the facility, which represents a $3,500,000 investment, is expected in April, 1956. Capacity will be more than 100,000 tons a year of 4½ to 16 in. pipe, made to American Petroleum Institute specifications.

Fluor Corp. of Canada is construct-

ing the plant, and J. E. Cunningham, former district engineer for Fluor in Houston, has been named vice-president and general manager of the new corporation.

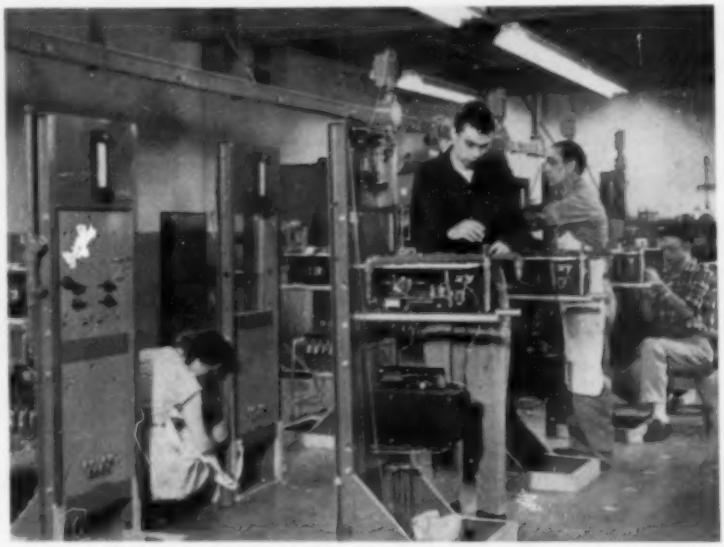
Dresser, Electronics to Merge

Merger of Southwestern Industrial Electronics Co. with Dresser Industries has been agreed by officials of both companies. Dresser supplies oil, gas and chemical equipment and technical services. The merger is subject to approval by directors of both firms.

Present management of Southwestern Electronics will continue to operate the company after merger.

NY Engineering Firm Opens

Engineering Design and Development Co. is a new firm located at 25 Broad St., New York City. It lists among its services the engineering, design, procurement and installation of chemical, metallurgical and other industrial plants. At the head of the firm's management is Mr. P. Sphaellos.



INFRARED ANALYZERS developed by Phillips Petroleum Co. come off the assembly line at Consolidated Engineering (now Consolidated Electrodynamics) Corp., which will also market them. A Phillips process refractometer is also in production. This is the first time the two instruments have been available except by special order.

Personnel Changes

Taylor Instrument Cos.—Richard N. Pond, divisional sales manager, has been elected vice-president of the Instrument Society of America. He has responsibility for the society's technical division.

Worthington Corp.—George F. Habach to vice-president in charge of engineering. He was formerly manager of engineering of the Harrison Division.

Foxboro Co.—Vincent V. Tivy, formerly manager of refinery instrument sales, to chief application engineer, responsible for coordinating sales engineering with product development and production engineering activities.

Chicago Bridge & Iron Co.—Robert S. Chamberlin from the Chicago to the San Francisco sales office; Arthur G. Albertson to the Los Angeles sales office; Julius D. Holmquist to the Philadelphia sales office.

Wolverine Tube Div.—William Bothwell to the aluminum department; he is succeeded as sales representative in the New York-New Jersey area by William M. Robertson, who was moved up from Rochester, N. Y.

ALCO Products, Inc.—Everett N. Sieder to marketing manager of thermal products, responsible for sales of heat exchangers, evaporators, feedwater heaters, pressure vessels, etc.; William L. Clark to product manager of the "Alcoplate" process, a new method of chemical nickel plating.

Consolidated Engineering Corp.—Charles C. Snider to manager of field sales, with jurisdiction over regional offices in Chicago, Dallas, Atlanta, Philadelphia, and Pasadena, and district offices in New York, Detroit, Boston, Washington, D. C., Buffalo, Albuquerque, Palo Alto, and Seattle. Joseph E. Jenkins succeeds him as manager of the southeastern regional office at Atlanta; Dr. Leland G. Cole, physical chemist formerly with Robertshaw-Fulton Controls Co., to the research staff.

Lummus Co.—S. A. Guerrieri to the technical staff; he was formerly chief process engineer of Arthur G. McKee and Co.

Davison Chemical Co.—Dr. Frank G. Ciapetta, formerly with Socony Mobil Oil Co., to director of catalyst research.

Otto H. York Co.—Dr. Edward G. Scheibel to director of engineering.

Arthur G. McKee and Co.—F. D. (Drake) Parker, former manager of Blaw-Knox Co. chemical plants division, to the petroleum division.

Food Machinery and Chemical Corp.—Robert P. Young to manager of the New York district office of Peerless Pump Division, succeeding F. W. McCann, who has resigned.

Refinery Engineering Co.—H. V. Flemming, from sales manager to vice-president of sales; Paul H. Smith, from chief estimator to vice-president of construction.

International Nickel Co.—Lester E. Johnson to supervisor of the industrial chemicals section of the development and research division.

Branches, Distributors

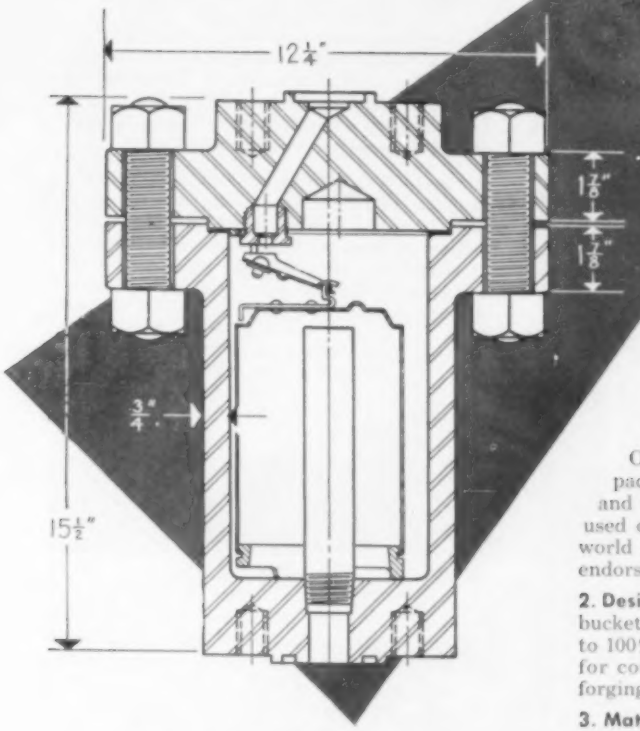
Petro-Chem Development Co. has appointed Rawson & Co., Houston, distributors for Texas, minus the Panhandle, Louisiana, and southern Arizona; Wm. H. Mason Co. has been given the northern Arkansas and Kansas City areas.

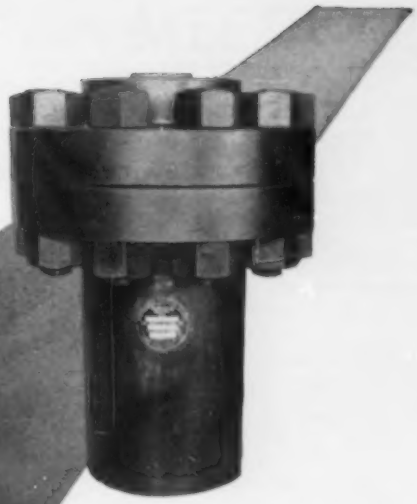
Expansion, Transition

Wolverine Tube Div. of Calumet and Hecla has moved to larger quarters in Louisville, Ky. The new offices are at 5330 S. Third St.

B-I-F Texas, Inc., southwest division of B-I-F Industries, Inc., has moved its Houston office to 2435 N. Boulevard. The phone remains the same.

WHAT TO LOOK FOR IN A HIGH PRESSURE-- HIGH TEMPERATURE STEAM TRAP....





High pressure – high temperature service is no place to cut corners, no place to to take chances. Here are some things to think about in specifying steam traps:

1. Experience—Since right after World War One, Armstrong trap development has kept pace with the trend to higher and higher pressures and temperatures. These traps are the most widely used of any in leading power plants throughout the world at pressures up to 2400 psig—there is no finer endorsement.

2. Design—The simple, dependable Armstrong inverted bucket mechanism provides the closest thing possible to 100% assurance that the trap will not fail to open for condensate and close for steam. Extra heavy forgings provide large safety margins.

3. Materials—see list at left.

4. Price—Armstrong forged steel trap list prices range from $95 to over $1000. The No. 515 shown above is rated for 1500 psig at 900°F and for 2000 psig at 600°F. It lists at $500. Armstrong prices are moderate for what you get because of high production. *There is no compromise made at the expense of safety, quality and low maintenance.*

Want more facts?—Call your local Armstrong Representative or write: Armstrong Machine Works, **826** Maple Street, Three Rivers, Michigan.

Do you have Catalog J?—This 44-page Steam Trap Book is free on request.

LIST OF MATERIALS
ARMSTRONG FORGED STEEL TRAPS

Part	Material
CAP AND BODY FORGINGS	
Up to 600 psi, 750°	1030 carbon steel
Up to 900 psi, 900°	ASTM Spec. F-1 carbon moly steel
Up to 2500 psi, above 900°	ASTM Spec. F-5 chrome moly steel
VALVE AND SEAT	Type 440 chrome steel, heat treated, standard. Stellite available.
LEVER MECHANISM	Stainless steel
BUCKET	Stainless steel
BOLTS	Class C high tensile, high temperature bolting material—125,000 min. tensile.
NUTS	Hex, semi-finish, heat treated for high pressure, high temperature service.
GASKET	Compressed graphited asbestos
INLET TUBE	Wrought iron

ARMSTRONG

STEAM TRAPS FOR EVERY REQUIREMENT — APPLICATION ENGINEERED

STEAM TRAPS

THE EYE OF TIME

"THE EYE OF TIME"
jeweled timepiece by Salvador Dali,
shown by permission of
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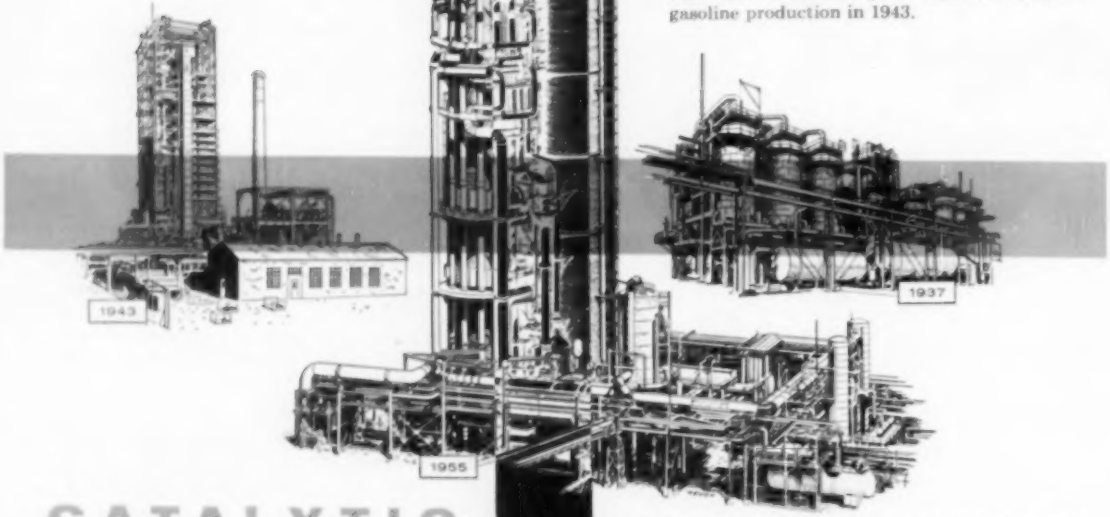

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SAE Annual in Detroit Jan. 9-13

THE big annual meeting of the Society of Automotive Engineers will be held in Detroit from Jan. 9 to 13 at the Statler and Sheraton-Cadillac Hotels.

The Fuels and Lubricants Activity is sponsoring sessions on Thursday, Jan. 12, and Friday, Jan. 13. The Thursday morning session will have J. F. Kunc, Jr., as chairman and G. S. Tobias as secretary. Both men are from Esso Research & Engineering Co.

Only two papers will be heard in this first session. "Wear—Where and When" is by R. J. Pocock of Ford Motor Co. "The Chevrolet L-4 Test—What Does It Measure?" will be the contribution of R. J. DeGray, Standard Oil Co. (Ohio).

In the afternoon session, Leonard Raymond and H. S. Kelly, of Socony Mobil Oil Co., will be respectively chairman and secretary. Reading of papers will follow a business session of the Fuels and Lubricants Activity and presentation of the Horning memorial award to Bernard M. Sturgis, of Du Pont Co.

The first paper will be "New Instrumentation for Engine Combustion Studies," by J. A. Warren and J. B. Hinkamp, Ethyl Corp. It will be followed by:

"An Instrument for Recording the Cylinder Pressure vs. the Crank Angle of an Internal Combustion Engine," by R. R. Bockmuehl, Research Laboratories Division, General Motors Corp.

"Once More About Mechanical Octanes," by Otto Enoch and J. M. Chandler, Ford Motor Co.

The Activity's Friday morning meeting will have R. W. Goodale, Standard Oil Co. of California, as chairman, and J. A. Miller, California Research Corp., as secretary. Papers to be read at this session are as follows:

"The Relationship of Low Temperature Cranking Resistance to Viscosity Characteristics of Multigrade Engine Oils," by G. K. Malone and T. W. Selby, General Motors Corp., Research Laboratories Division.

"Cold Starting with V. I. Improved, Multigrade Oils," by F. B. Fischl, Enjay Labs Division, and H. H. Horowitz and T. S. Tutweiler, Products Research Division, all of Esso Research & Engineering Co.

"How Do Volatility, Viscosity and V. I. Improvers Affect Oil Consumption?", by R. L. Overcash, W. Hart, and D. J. McClure, of Kendall Refining Co.

Committee meetings of the Fuels and Lubricants Activity will be held according to this schedule:

The technical committee at 9:30 a.m. on Jan. 11.

The meetings committee at 4:30 p.m. on Jan. 12.

The general and meetings committees at luncheon (12 noon) on Jan. 12.

Maintenance Show Offers Refining Round Table

Round-table discussions of six industries, including petroleum refining, will be part of the 7th annual Plant Maintenance and Engineering Conference, to be held concurrently with the Plant Maintenance and Engineering Show at Convention Hall, Philadelphia, from Jan. 23 to 26.

The program has been arranged in three groups: two general sessions, eight concurrent sectional conferences, and 16 concurrent round tables for discussion of special problems. The sectional conferences and round tables will be repeated a second evening.

The show is expected to display the products and services of some 400 companies and to attract an attendance of 20,000 persons.

In addition to round-table discussions of maintenance problems in the petroleum refining, chemical, and four other industries, there will be the same type of session on the following subjects: "Maintenance of Yard Structures and Yard Equipment," "How Punched Cards Facilitate Maintenance," "Getting the Most Out of Electrical Equipment," "Lubrication Practices," "Maintenance of Machine Tools," "Report Writing," "Relation of Maintenance and Purchasing Departments," "Insuring Effective Utilities for the Plant," "Forms, Records and Reports," and "Tool Room Control."

The conference will start with a general session on "How We Look at Preventive Maintenance," with a case study from a metal-working plant and a process plant. Another general conference will be on "Maintenance Controls," including the topics "Planning and Scheduling as Designed for Effective Cost Control," "Inspection Procedures to Control Quality," and "Making the Maintenance Personnel Control-Minded."

The eight sectional conferences will consider these subjects: "Getting Maintenance People to Work as a Team," "Yardsticks to Measure Effectiveness of Maintenance," "Sanitary Standards and How to Meet Them," "Equipment Replacement Policies," "Using the Services of Independent Contractors," "Maintenance in Plants on 24-hour Operation," "Maintenance Painting," and "Design and Operation of Maintenance Shops."

API Refiners Plan Mid-Year Meeting

Some preliminary details of the mid-year meeting of the American Petroleum Institute's Division of Refining have been announced. The meeting, from May 14-17, will be held in Montreal, making this the first time the Refining Division has taken a meeting outside the U. S.

Program of the meeting is in the hands of a committee headed by G. L. Mateer, vice-president of Cities Service Petroleum, Inc. Two sessions on analytical research are being developed by the committee on analytical research, of which C. E. Headington, Atlantic Refining Co., is chairman.

The committee on training, headed by Dean S. Turner, Standard Oil Co. (Ohio), is preparing a session on training.

There will be sessions on air pollution and waste water disposal sponsored by the smoke and fumes committee and the committee on disposal of refinery wastes. W. H. Claussen, California Research Corp., chairman of the former, is collaborating with John Easthagen, of the same firm, chairman of the latter group.

Corrosion, electrical equipment and instrumentation will be dealt with in three sessions of special interest to mechanical engineers in the refining industry.

In addition, the early plans call for a session on processes, one on fuels, and one on refinery maintenance.

Program for Texas A. & M. Instrument Symposium

Some tentative program details have just been released of Texas A. & M. College's popular symposium on Instrumentation for the Process Industries. The meeting will be held Jan. 25 to 27 at College Station, the university campus.

The technical keynote address will be given by P. S. Dickey, president of Bailey Meter Co.

The first technical paper will be given by Dr. Donald P. Eckman, Case Institute of Technology, on electronic

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OF PETROLEUM PROCESSING published monthly at Philadelphia, Pa., for October 1, 1955.

1. The name and address of the publisher, editor, managing editor and business manager is: Publisher McGraw-Hill Publishing Company, Inc., 330 West 42nd Street New York 36, N. Y.; Editor, William F. Bland, 330 West 42nd Street, New York 36, N. Y.; Managing editor William C. Uhl, 330 West 42nd Street, New York 36, N. Y.; Business manager Richard H. Layer, 330 W. 42nd St., New York 36, N. Y.

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McGRAW-HILL PUBLISHING COMPANY, INC.
By J. A. GERARDI, Vice Pres. & Treas.

Sworn to and subscribed before me this 15th day of September, 1955.
[SEAL] ELVA G. MARLIN.
(My Commission expires March 30, 1956)

Meetings

control, including electrical valve operators and direct prime movers.

There will be a paper on the intrinsic safety of instruments used in hazardous locations, by L. E. Cuckler, Robertshaw - Fulton Controls Co., Fielden Instrument Division.

Data reduction equipment and its future in plant automation will be the topic of Arthur Freilich, of Minneapolis-Honeywell Regulator Co.

B. W. Knesby, Esso Research and Engineering Co., will talk about remote tank gaging and control.

There will be a paper on practical applications of systems engineering, and one on advanced methods of flow measurements. The authors of these were not announced.

The symposium will present five papers of about 10 min. each on unusual applications of instruments and will also feature a panel session in which small groups will discuss any one of four designated subjects.

Oil Man's Calendar

DECEMBER

Nuclear Engineering and Science Congress and *International Atomic Exposition*, Public Auditorium, Cleveland, Dec. 12-16.

JANUARY

Society of Automotive Engineers, annual, Sheraton-Cadillac and Statler Hotels, Detroit, Jan. 9-13.

7th Plant Maintenance and Engineering Conference and Show, Convention Hall, Philadelphia, Jan. 23-26.

Symposium on Instrumentation for the Process Industries, Texas A. & M., College Station, Jan. 25-27.

American Institute of Electrical Engineers, winter meeting, New York, Jan. 30-Feb. 3.

FEBRUARY

American Institute of Mining and Metallurgical Engineers, annual, Statler Hotel, New York City, Feb. 19-23.

Natural Gasoline Assn. of America, Permian Basin regional meeting, Lincoln Hotel, Odessa, Feb. 25.

National Society of Professional Engineers, spring meeting, Statler Hotel, Washington, D.C., Feb. 24-25.

American Institute of Chemical Engineers, national meeting, Statler Hotel, Los Angeles, Feb. 26-29.

MARCH

Chemical Institute of Canada, 6th divisional conference, Guildwood Inn, Sarnia, Ont., Mar. 5-7.

National Assn. of Corrosion Engineers, corrosion conference, Statler Hotel, New York City, Mar. 12-16.

Western Petroleum Refiners Assn., annual meeting, Plaza Hotel, San Antonio, Mar. 19-21.

APRIL

National Petroleum Assn., semi-annual meeting, Hotel Cleveland, Cleveland, Apr. 18-20.

MAY

American Petroleum Institute, mid-year meeting, Montreal, May 14-17.

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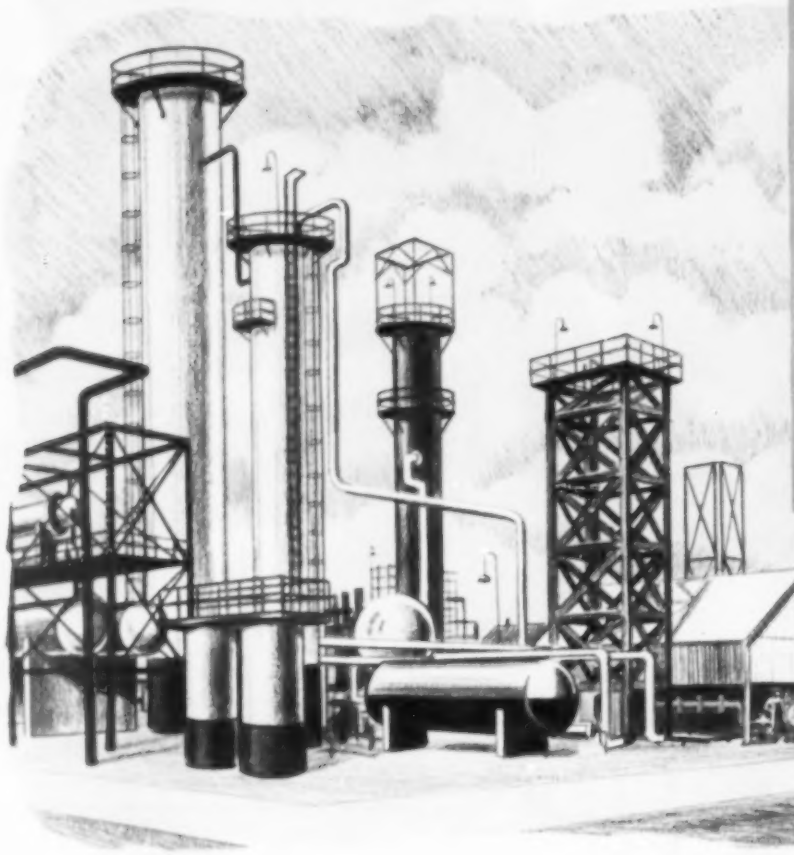

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New NGAA Equilibrium K-Charts

Equilibrium Ratio Data Book, 8½x11 in., 131 charts with introductory explanatory text: available in 5-ring looseleaf heavy canvas binder, $12 or charts alone punched for 3-ring binder, $9. Natural Gasoline Assn. of America, 421 Kennedy Bldg., Tulsa 3, Okla.

A NEW source of badly needed equilibrium vaporization data has been published by the Natural Gasoline Assn. of America as part of its continuing service to the natural gasoline industry. This gives the so-called "K-factors" for higher pressures and lower temperatures, where hydrocarbons depart more radically from so-called "ideal" behavior and become dependent upon composition.

The new NGAA data have been published by its standing Equilibrium Ratio Committee, composed of authorities who were charged to select such a set of charts as these. The committee also acts as a clearing house for new equilibrium data and correlation methods. It hopes to extend its work to include studies on enthalpies and partial molal enthalpies of equilibrium liquids and vapors.

The present data were in large part compiled by Dr. G. G. Brown, University of Michigan, from published and unpublished sources and prepared in chart form by the process engineering department of the Fluor Corp., Ltd., along with data of its own.

The data presented, used in the design of absorbers, strippers, stabilizers and similar equipment, make use of the Hadden "convergence pressure" concept which relates K-factors in a complex mixture at given temperature and pressure with a hypothetical binary system having the same convergence pressure. The data used are a smoothing of available experimental K-ratio data.

While admittedly not the most accurate, simple, or complete correlation, it is the most suitable of any known for routine computations. There are many other systems which might have been used, some excelling in simplicity, others in accuracy. Unfortunately none is as accurate as desired or as simple in application as it should be.

Natural Gasoline Supply Men's Assn., in cooperation with NGAA, brought out in 1951 in its widely distributed handbook, "Engineering Data Book," what then were the latest available data on "ideal" equilibrium ratios. Good as far as they went and still accepted generally as unofficial standards wherever they were applicable, these data will probably be superseded by NGAA's new "Equilibrium Ratio Data Book."

The data book contains instructions on the use of the K-charts (together with an extensive bibliography) as well as convergence pressure charts giving the critical loci of hydrocarbon systems and pressures for absorbers, strippers, and stabilizers.

Also included are K-charts at convergence pressures ranging from 600 to 20,000 psia for the paraffin series through decane plus propylene and ethylene, nitrogen, CO_2, hydrogen in hydrogen sulfide, and various paraffin hydrocarbons. Other charts include hydrogen in benzene and toluene, water content of hydrocarbon vapors and liquids, solubilities of hydrocarbons in water, "PTX Graphs" of hydrogen sulfide in ethane and propane.

Recent Books Briefly Noted

Contributions to the Solution of Systems of Linear Equations and the Determination of Eigenvalues. Applied Mathematics Series No. 39, edited by Olga Taussky, 10½ x 8 in., 139 pp., table of contents, cloth cover, $2.00, National Bureau of Standards, U.S. Government Printing Office, Washington 25, D.C.

. . . has 7 papers describing many methods of solving linear equations and inverting matrices with emphasis on elimination methods and related schemes involving the triangular resolution of matrices and some attention to iterative solutions, has 26 numerical examples — usually for matrices of order six—with complete computational layout and full details, particular value is anticipated for all problems incorporating simultaneous equations and for organizations having high-speed digital computing machines.

IP Engine Test Methods for Rating Fuels, first edition, 84 pp., 5½ x 8½ in., illustrated table of contents, £1—postpaid and computed at the standard rate of exchange, The Institute of Petroleum, 26 Portland Place, London, W. 1 England.

. . . publication covering the engine test methods for rating motor, aviation and diesel fuels, including knock rating of motor and aviation fuels and ignition quality of diesel fuels, designed for the convenience of laboratory operators.

Physical Constants for the Paraffin Hydrocarbons and other Components Associated with Natural Gas, Publication 2145, revised edition, 4 pp., 8½ x 11 in., $0.25 on orders of 25 or more, $0.20 each, Natural Gasoline Association of America, 421 Kennedy Building, Tulsa 3, Okla.

. . . list of physical properties—ideal and corrected for vapor density, gas: liquid volume ratio, and gross heat of combustion of lighter hydrocarbons methan through butane—for hydrocarbons methan through n-decane, plus carbon dioxide, nitrogen, oxygen, air, hydrogen sulfide and water.

ASTM Standards on Petroleum Products and Lubricants, prepared by ASTM Committee D-2, Nov., 1954, 6 x 9 in., 980 pp., table of contents, illustrated, paper cover, $6.65, American Society for Testing Materials, 1916 Race St., Philadelphia 3, Pa.

. . . compilation of specifications, indexes and definitions covering petroleum products and lubricants giving latest approved form for over 100 test methods and including several appendixes covering proposed tests of jet fuels, steam turbine oils and aviation fuels.

Symposium on Radioactivity—An Introduction, presented at 56th annual meeting of ASTM, Atlantic City, N J., June 30, 1953, 6 x 9 in., 54 pp., table of contents, illustrated, paper cover, $1.75, American Society for Testing Materials, 1916 Race St., Philadelphia 3, Pa.

. . . compilation of papers on properties and uses of radioisotopes, applications of radioactive measurements, design of radioisotope laboratories, training personnel, detection and measurement of nuclear radiation, management problems arising from radioisotope use by industry, etc.

ASTM Standards on Electrical Insulating Materials, prepared by ASTM Committee D-9, Feb., 1955, 6 x 9 in., 660 pp., indexed, illustrated, paper cover, $5.50, American Society for Testing Materials, 1916 Race St., Philadelphia 3, Pa.

. . . compilation of 60 test methods, 17 specifications, 3 recommended practices, and 1 list of definitions with 33 of the designations either being new or revised since the last edition in 1953, and four appendices.

Directory of Contract Packagers, third edition, 1955, $5.00, Packaging Institute, 342 Madison Ave., New York 17, N Y

. . . lists equipment and other packaging facilities of some 163 plants accepting contract packaging work, lists type of materials acceptable or unacceptable, and any special laboratory, processing, etc., facilities.

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Do you need detailed information on a specific subject? Check through this easy-to-use index of literature and data being offered in this issue's advertisements.

ADDITIVE, fuel oil, ashless, booklet on test procedures; Carlisle Chemical Works. See adv't. p. 1861.

ADDITIVES, fuel, booklet describes testing; Ethyl Corp. See adv't. pp. 1920-1921.

ALLOYS, for corrosive conditions, booklet; Haynes-Stellite Co. See adv't. p. 1931.

ALUMINUM, for heat exchangers, brochure; Reynolds Metals Co. See adv't. pp. 1854-1855.

ALUMINUM, for process industries, booklet; Alcoa Aluminum. See adv't. p. 1859.

BARIUM CHEMICALS, for lube oil additives, booklet; Westvaco Mineral Products. See adv't. p. 1962.

BUBBLE CAPS, 300 styles listed in bulletin 22; Pressed Steel Co. See adv't. p. 1984.

CATALYSTS, many types, booklet; Harshaw Chemical Co. See adv't. p. 1971.

CATALYTIC CRACKING, "Houdriflow," brochure; Houdry Process Corp. See adv't. p. 1948A.

CATALYTIC REFORMING, new process, booklet; M. W. Kellogg Co. See adv't. pp. 1938-1939.

CHLORINATION SYSTEMS, to control slime, booklet RA-2061-6; Wallace & Tiernan, Inc. See adv't. p. 1848.

CLEANING COMPOUND, for process equipment, bulletin F-3751; Oakite Products, Inc. See adv't. p. 1974.

CONDUIT, electrical, rigid, aluminum, booklet; Alcoa Aluminum. See adv't. p. 1982.

DRYING AGENTS, dessicants, information on request; Minerals & Chemicals Corp. See adv't. p. 1985.

DRYING EQUIPMENT, for air, gas and organic liquids, booklet; Pittsburgh Lectrodryer Corp. See adv't. p. 1991.

ENTRAINMENT SEPARATORS, hi-thruput, booklet ME-5; Metal Textile Corp. See adv't. p. 1934.

FLAME CUTTER, for welding fittings, bulletin FC-2; Vernon Tool Co. See adv't. p. 1946.

FLOWMETERS, bulletin on request; Emil Greiner Co. See adv't. p. 1984.

FURFURAL, for solvent extraction, bulletin 203-A; Quaker Oats Co. See adv't. p. 1987.

GAGES, and water columns, catalog; Ernst Water Column & Gage Co. See adv't. p. 1951.

GREASE KETTLES, catalog 356-R; Blaw-Knox Co. See adv't. p. 1983.

INSULATION, cellular glass, literature; Pittsburgh Corning Corp. See adv't. p. 1874.

METAL DEACTIVATOR, to control copper compounds, technical data; Tretolite Co. See adv't. p. 1925.

MIXERS, side and top entering, eight catalogs on mixers and associated equipment. Mixing Equipment Co. See adv't. p. 1876.

MOTOR STARTERS, oil-immersion type, booklet 1062; Electric Controller & Mfg. Co. See adv't. p. 1992.

OXYGEN ANALYZERS, continuous measurement of process streams, data file 15J-125; A. O. Beckman, Inc. See adv't. p. 1976.

PAINT, aluminum, heat resistant, booklet; Alcoa Aluminum. See adv't. p. 1977.

REFRACTORY GRAIN, fused alumina, booklet; Norton Co. See adv't. p. 1836.

STEAM TRAPS, catalog 953; W. H. Nicholson & Co. See adv't. p. 1948.

STEAM TRAPS, for high pressure and temperature, catalog J; Armstrong Machine Works. See adv't. p. 1955.

STEEL FABRICATION, for refineries, general catalog; Flint Steel Corp. See adv't. p. 1988.

STEEL, stainless, for refineries, booklet; U. S. Steel Corp. See adv't. p. 1975.

STORAGE FACILITIES, for bulk liquid, new illustrated booklet; Hess Terminal Corp. See adv't. p. 1860.

TUBING, for condensers and exchangers, technical booklet and catalog; Wolverine Tube. See adv't. pp. 1860A-1860B.

VALVES, forged steel, gate, globe, angle, catalog supplement 1; Henry Vogt Machine Co. See adv't. pp. 1862-1863.

VALVES, sampling, drain, information; Jerguson Gage & Valve Co. See adv't. p. 1970.

ADVERTISERS' INDEX

This index is published as a convenience to the reader. Every care is taken to make it accurate, but PETROLEUM PROCESSING assumes no responsibility for errors or omissions.

FOR INFORMATION ON ANY PRODUCT OR SERVICE ADVERTISED IN THIS ISSUE SEE INSTRUCTIONS BELOW

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Airetool Mfg. Co. (J-6) 1990
Air Preheater Corp. (F-8) 1947
Air Products, Inc. (E-4) 1930
Aluminum Co. of America, Elect. Prods. Div. (I-6) 1982
Aluminum Co. of America, Pigments Div. (I-1) 1977
Aluminum Co. of America, Process Equip. Div. (B-9) 1859
American Cyanamid Co., Refinery Chem. Dept. (C-6) 1865
Anaconda Co. (D-3) 1873
Annin Co. (F-6) 1946
Armstrong Machine Works (G-5) 1955

B

Babcock & Wilcox Co., Boiler Div. (J-5) 1989
Badger Mfg. Co. (E-1) 1924
Baker & Co. (E-8) 1935
Barco Mfg. Co. (I-2) 1978
Beckman, Inc., A. O. (H-9) 1976
Betz, W. H. & L. D. (J-9) 1993
Bigelow-Liptak Corp. (I-3) 1979
Blaw-Knox Co. (I-7) 1983

C

Carlisle Chemical Works (C-3) 1861
Catalytic Const. Co. (G-6) 1956
Chicago Bridge & Iron Co. (F-1) 1937
Cities Service Co. (H-6) 1973
Cooper-Bessemer Corp. (I-5) 1981
Crane Co. (E-3) 1926

D

Davison Chemical Co., Div., W. R. Grace & Co. (G-7) 1959
Dempster Brothers, Inc. (K-1) 1994-1995
Dow Chemical Co. (F-5) 1945
Dowell, Inc. (A-4) 1837
Dresser Industries, Inc. (C-8) 1868-1869
DuPont de Nemours & Co., Inc. (B-2) 1848A-1848B
DuPont de Nemours & Co., Inc. (G-2) 1948B

E

Elec. Controller & Mfg. Co. (J-8) 1992
Enjay Co. (F-4) 1942
Ernst Water Column & Gage Co. (G-3) 1951
Ethyl Corp. (D-8) 1920-1921

F

Fisher Governor Co. (D-7) 1919
Flint Steel Corp. (J-4) 1988
Foster Wheeler Corp. (A-8) 1844

G

Gen'l Amer. Trans. Corp. Plate & Welding Div. (A-5) 1838
Gen'l Amer. Trans. Corp. Terminals Div. (A-6) 1840
Gen'l Chemical Div. Allied Chem. & Dye Corp. (K-2) Cover 3
General Refractories Co. (F-3) 1940
Glitsch & Sons, Inc., F. W. (E-9) 1936
Greiner Co., Emil (I-9) 1984

H

Harshaw Chemical Co. (H-4) 1971
Hercules Powder Co. (B-3) 1852
Hess Terminal Corp. (C-1) 1860
Houdry Process Corp. (G-1) 1948A

J

Jerguson Gage & Valve Co. (H-3) 1970

K

Kellogg Co., M. W., Fabricated Prods. Div. (C-7) 1866-1867
Kellogg Co., M. W., Contract Sales Div. (F-2) 1938-1939
Key Co. (D-5) 1875
Koch Engineering Co. (D-1) 1871

L

Lukens Steel Co. (C-9) 1870
Lummus Co. (A-7) 1843

M

Marley Co. (B-5) 1853
McKee Co., Arthur G. (B-7) 1856-1857
Metal Textile Co. (E-7) 1934
Midvale Co. (D-2) 1872
Minerals & Chemicals Corp. (J-1) 1985
Mixing Equipment Co. (D-6) 1876

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National Aluminate Corp. (D-9) 1922
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Nicholson & Co., W. H. (F-9) 1948
Norton Co. (A-3) 1836

O

Oakite Products, Inc. (H-7) 1974
Oilwell Supply Co. (A-2) 1833
Olin Mathieson Chem. Corp. (H-1) 1967
Omega Machine Co., Div., B-I-F Industries (A-1) Cover 2
Oronite Chemical Co. (I-4) 1980

P

Petro-Chem. Development Co. (E-6) 1932
Pittsburgh Corning Corp. (D-4) 1874
Pittsburgh Lectrodryer Corp. (J-7) 1991
Powell Co., William (H-2) 1969
Pressed Steel Co. (I-8) 1984

Q

Quaker Oats Co. (J-3) 1987

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Reynolds Metals Co. (B-6) 1854-1855
Ridge Tool Co. (A-9) 1847
Rockwell-Nordstrom Valves (B-4) 1852A-1852B

S

Santa Fe Tank & Tower Co. (K-3) Cover 4
Struthers Wells Corp. (C-5) 1864

T

Tickle Engr. Works, Arthur (J-2) 1986
Tretolite Co. (E-2) 1925

U

Union Carbide & Carbon Co., Haynes-Stellite Co. (E-5) 1931
U. S. Gasket Co. (H-5) 1972
U. S. Steel Corp. (H-8) 1975

V

Vernon Tool Co. (F-7) 1946
Vogt Machine Co., Henry (C-4) 1862-1863

W

Wallace & Tiernan Prods., Inc. (B-1) 1848
Westvaco Mineral Products (G-9) 1962
Wolverine Tube, Calumet & Hecla, Inc. (C-2) 1860A-1860B

Z

Zallea Brothers (B-8) 1858

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A3	B3	C3	D3	E3	F3	G3	H3	I3	J3	K3	L3	M3	N3	O3	P3
A4	B4	C4	D4	E4	F4	G4	H4	I4	J4	K4	L4	M4	N4	O4	P4
A5	B5	C5	D5	E5	F5	G5	H5	I5	J5	K5	L5	M5	N5	O5	P5
A6	B6	C6	D6	E6	F6	G6	H6	I6	J6	K6	L6	M6	N6	O6	P6
A7	B7	C7	D7	E7	F7	G7	H7	I7	J7	K7	L7	M7	N7	O7	P7
A8	B8	C8	D8	E8	F8	G8	H8	I8	J8	K8	L8	M8	N8	O8	P8
A9	B9	C9	D9	E9	F9	G9	H9	I9	J9	K9	L9	M9	N9	O9	P9

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57	58	59	60	61	62	63	64
65	66	67	68	69	70	71	72
73	74	75	76	77	78	79	80

ADVERTISED PRODUCTS

A1	B1	C1	D1	E1	F1	G1	H1	I1	J1	K1	L1	M1	N1	O1	P1
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A3	B3	C3	D3	E3	F3	G3	H3	I3	J3	K3	L3	M3	N3	O3	P3
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A9	B9	C9	D9	E9	F9	G9	H9	I9	J9	K9	L9	M9	N9	O9	P9

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about products and services advertised in this issue of Petroleum Processing or reviewed in its "What's New" section, use the postage-free cards provided below.
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New York, N. Y.

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PETROLEUM PROCESSING

330 WEST 42nd STREET

NEW YORK 36, N. Y.

WHAT'S NEW...

Sand Blasting Tool

. . . Cleans The Inside of Pipes

By merely passing this tool through the inside of a pipe or tubing it removes scale or deposits. There is no need to rotate the pipe or the tool.

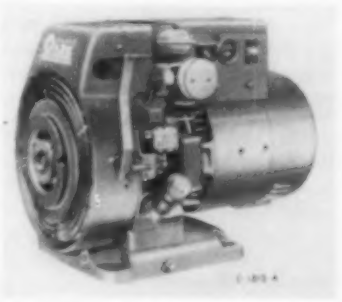
The "Torno-Blast" cleans by whirling the sand, or other abrasive material, under great pressure over a conical diverter that covers a complete 360 degrees. The blasting action removes alkali deposits and salts of corrosive liquids, mill scale, carbon, coke, and other substances which restrict the efficiency of process pipe.

The tool is available in four sizes: Model 100 cleans ½- to ¾-in. pipe; Model 200, ⅞ to 1½ in.; Model 300, 2 to 4 in., and Model 400 cleans 4- to 12-in. pipe. **J. C. Fennelly Co.,** 1485 Bay Shore Blvd., San Francisco, Calif.

Circle No. **1** *on Reply Card*

For More Information

Use one of the attached reply cards to request additional details or literature on any items reviewed in "What's New!" Just circle the numbers corresponding to the numbers at the end of each item in which you are interested. Then fill in the rest of the card and drop it in the mail. No postage is required.



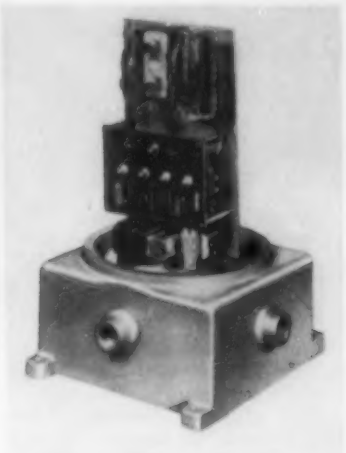
Electric Generator

. . . produces 2,000 watts, 60 cycle a-c in all standard frequencies and phases.

The 235-pound unit operates at 1800 rpm from a single-cylinder, air-cooled, 4-cycle gasoline engine. Manual starting models are equipped with recoil rope starter, mounted fuel tank, air cleaner, terminal box, and vibration dampeners. Remote starting models for electrical cranking come equipped with mounted control box, exhaust tubing and muffler, air-cleaner, separate fuel tank and battery cables. All models have radio shielding on high-tension wire and spark plug.

Optional accessories include carrying frames, 2-wheel dollies, automatic controls, emergency line transfer controls, receptacle plate kit, and gas-gasoline carburetors. **D. E. Onan & Sons, Inc.,** Minneapolis 14, Minn.

Circle No. **2** *on Reply Card*



Remote Temperature Reading

. . . system operates over private or leased wires, carrier or microwave facilities.

A trigger pulse sent from the control (or reading) station starts the transmitter on its indicating cycle, which is in three phases. First, a series of pulses starts the temperature reading at the selected, remote transmitter; second, another series of pulses identifies the transmitter and confirms it selection by sending appropriate signals back to the control station; and, third, a series of pulses is sent back to the control station which gives a direct indication of the temperature being measured. These last pulses set up an indicator at the control station which shows an accurate temperature reading.

This remote temperature reading system measures up to 500° F maximum, with a noral reading span of 130° F. Readings are to the nearest 1° F. Broader spans are obtained by accepting an indication to the nearest 2 or 3° F. **Shand & Jurs Co.,** Berkeley 10, Calif.

Circle No. **3** *on Reply Card*

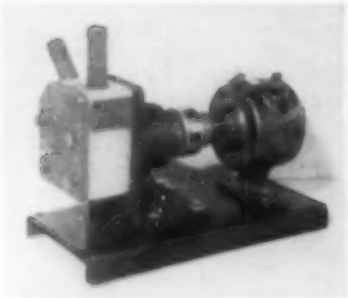
Dry Fire Extinguisher

. . . For Oil or Gasoline Fires

Pictured above is a demonstration of a newly designed fire extinguisher —which took place at Shell Oil's recycling plant at Sheridan, Texas. Man operating the nozzle at the right of the photograph is its inventor, L. J. Dugas.

This type of extinguisher uses an extremely fine powder, which is blown over the burning area. The heat of the fire releases a harmless, inert gas with an expansion ratio of more than 1100 to 1. This inert gas smothers the fire quickly, and can be used on electrical fires since it is non-conducting. The basic chemicals will not freeze, harden, or deteriorate during storage. **L. J. Dugas Co.,** 3382 Old Spanish Trail, Houston, Texas.

Circle No. **4** *on Reply Card*



Air Driven Pump

. . . **is explosion proof** for the handling of hazardous liquids.

This self-contained and portable unit offers a wide range of variable speeds by means of a simple valve control on the air supply. There is no stuffing box or mechanical seal, and the only wearing part of the pump is an inexpensive "Flex-i-Liner." A reversible feature for operating the pump in either direction is available.

Overall dimensions are 13-in. x 7¼-in. x 5¼-in. deep. Capacities range to 20 gpm and pressures to 50 psi. The pumps are furnished in plastic, rubber, or stainless-steel construction. **The Vanton Pump & Equipment Corp.,** 201 Sweetland Ave., Hillside, N. J.

Circle No. **5** *on Reply Card*

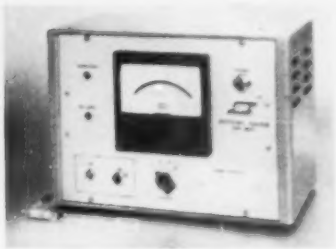
Leveling Mount

. . . **controls vibration** and reduces transmission of machine noise and shock.

It consists of a metal plate with a neoprene pad cemented to it, a threaded bolt, flanged leveling nut, and a lock nut. This unit is inserted on the base of the equipment piece (as illustrated) and does not require lagging machinery to the floor. Due to the shape and material of the neoprene pad, which is resistant to attack by oil, grease, and floor washing compounds, the machine will not walk or creep.

The MB Leveling Mount is available in six models of three sizes (3x3 in., 6x6 in., 9x9 in) with two types of pads, dependent on the loading. Permissible loads range from 100 to 12,000 lb per mount. **MB Manufacturing Co., Division of Textron-American, Inc.,** 1060 State St., New Haven 11, Conn.

Circle No. **6** *on Reply Card*



Vacuum Gage

. . . **reads from 100 to 0.001 mm Hg,** and can actuate an external relay circuit for valve operation.

The Autovac is a self-balancing, direct-reading, hot-wire type gage which will accommodate four gage tubes. A selector switch on the front panel connects any tube to the reading circuit. A special range selection circuit allows automatic switching from the millimeter range (100 to 0.1 mm Hg) to the micron range (100 to 1 micron Hg). When the instrument is in the millimeter range a red pilot lamp burns.

The gage circuit contains a resistance-bridge circuit fed from an 800 cps oscillator, with the wire of the gage tube forming one branch of the bridge. When the temperature is about 120°C. the bridge is in balance. Any change in the gage tube pressure causes a change in the wire temperature and in the wire resistance. The unbalanced bridge output is fed to an amplifier. Through a feedback loop the bridge is returned toward balance and the temperature of the wire to its original value. The voltage—after rectification —is fed to the indicating microammeter.

The Autovac operates from 110- to 240-volt, 50/60 cycle a.c. It measures 12¼ x 6¾ x 8½ in. Made in Sweden by LKB-Produkter, it will be sold through the nation-wide marketing facilities of **Consolidated Vacuum Corporation,** Rochester, New York.

Circle No. **7** *on Reply Card*

What's in prospect for petroleum?

While not as much in evidence here as the gasoline, there are many other important products of petroleum in this picture.

Today, few processes are as prolific as petroleum refining. In addition to new high-octane fuels and improved lubricants, many new plastics, paints, dyestuffs, detergents, and drugs owe their origin to a refinery. And, as the list grows longer, so grow the requirements of one of the nation's largest chemical-consuming industries.

To anticipate and provide for the diverse chemical requirements of the petroleum industry, Olin Mathieson offers a unique program of *coordinated planning and production*. This assures refiners and processors of the availability of chemical raw materials regardless of changing market conditions, new product developments, or requirements for plant expansions.

At present, a growing number of chemical consumers are coordinating their planning and production with Olin Mathieson . . . America's prime producer of basic industrial chemicals. Olin Mathieson's long experience and familiarity with the broad market picture will prove invaluable in *your* planning. Why not consult with us . . . now?

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INDUSTRIAL CHEMICALS DIVISION • BALTIMORE 3, MD

MATHIESON

INORGANIC CHEMICALS: Ammonia • Bicarbonate of Soda • Carbon Dioxide • Caustic Soda • Chlorine • Hydrazine and Derivatives • Nitric Acid • Hypochlorite Products • Nitrate of Soda • Soda Ash • Sodium Chlorite Products • Sulphate of Alumina • Sulphur (Processed) • Sulphuric Acid

ORGANIC CHEMICALS: Ethylene Oxide • Ethylene Glycols • Polyethylene Glycols • Glycol Ether Solvents • Ethylene Dichloride • Dichloroethylether • Formaldehyde • Methanol • Sodium Methylate • Hexamine • Ethylene Diamine • Polyamines • Ethanolamines • Trichlorophenol • Trichlorobenzene

3765

Valve Actuator

. . . **converts electrical signals** into a hydraulic stroke for operation of a control valve.

This self-contained unit includes control valve, hydraulic power source, and proportional positioning mechanisms that can be used with existing electronic controllers. Outside connections consist of the signal wires from the controller and an electric power supply.

The signal current is applied to a high-resistance coil (3000 ohms or more) which moves in a magnetic field. Linked to the coil is a patented jet pipe which converts an electrical signal of less than 50 milliwatts into thrusts of 600 lb. or more. The valve moves at a speed of one in./sec.; present stroke lengths are up to 2 in. **Askania Regulator Co.,** 240 East Ontario St., Chicago 11, Ill.

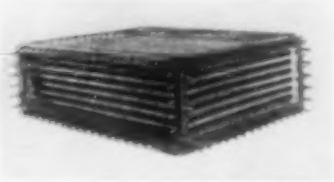
Circle No. **8** *on Reply Card*

Proportioning Pumps

. . . **of new, simple** and more efficient design will be introduced at the Chemical Show in Philadelphia in December by Proportioneers, Inc.

New features of the pump include check valves with a reversible seat, self-aligning connecting rod, self-venting reagent end, and check valves. At normal discharge pressures (2500 psi) or less, the capacity range is adjustable over more than 10-1 with repeatability of ±1% of rate. **Proportioneers, Inc.,** 345 Harris Ave., Providence, R. I.

Circle No. **9** *on Reply Card*

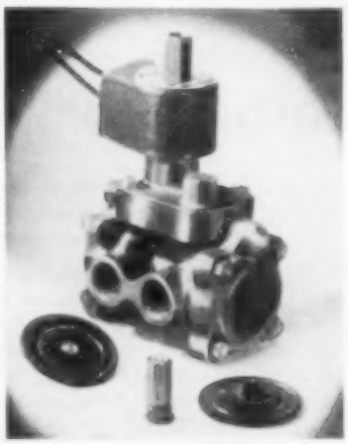


Heat Exchanger

. . . **for high temperature vapors** is designed for pressures up to 100 psi and temperatures up to 1100° F.

Produced primarily for gas-to-gas service, the "G-R Plate-Fin" exchanger consists of three basic parts: the corrugated sheet, the formed and butt welded flat tubes, and the blanked and extruded sheet metal tube sheets. All sealing surfaces on this cross-flow heat exchanger are heliarc welded, and all surfaces are protected with a nickel-base brazing alloy. This brazing alloy, which joins the corrugated sheets to the tubes, resists high temperature oxidation and corrosion. **The Griscom-Russell Co.,** Massillon, Ohio.

Circle No. **10** *on Reply Card*



3-Way Solenoid Valve

. . . **operates on a new principle** and uses only three moving parts.

This simple, packless valve has three operating parts—two hycar diaphragms and one stainless steel solenoid core. It can be converted from normally closed to normally open operation without removing from the pipeline: loosen two bolts and rotate the valve bonnet 180 degrees.

The brass body and bonnet measure 6½ x 4 in., and can be used for ⅜- or ½-in. pipe. It requires 10.5 watts A-C or 10 watts D-C to operate the solenoid. Rated for 250 psi. for liquids or gases. **Automatic Switch Co.,** 391 Lakeside Ave., Orange, N. J.

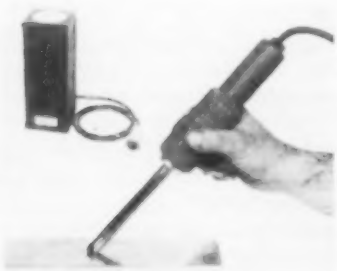
Circle No. **11** *on Reply Card*

Pump Seal

. . . **is self contained** and ready for installation.

The "Unitary" seal, complete with sleeve and gland, is pre-set at the factory and requires no on-the-job measurements. Circulating connections in the gland allow liquid at the sealing faces. Vent and drain connections, recommended on all hazardous operations, are optional. With parts of stainless steel, the seal is designed for process use on boiler feed pumps, chemical pumps, and oil refinery applications. **The Garlock Packing Co.,** Palmyra, N. Y.

Circle No. **12** *on Reply Card*

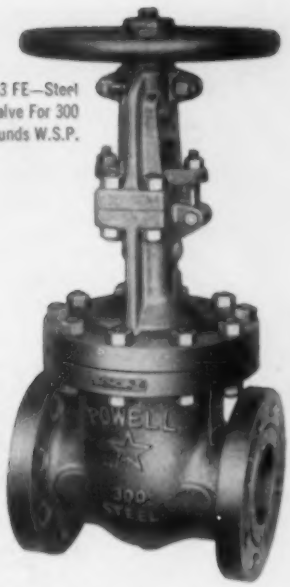


Fluxless Solder Iron

. . . **operates ultrasonically** and has an internal source of heat for melting solders.

Designed for fluxless soldering and tinning of aluminum, germanium, sili-

FIG. 3003 FE—Steel Gate Valve For 300 Pounds W.S.P.

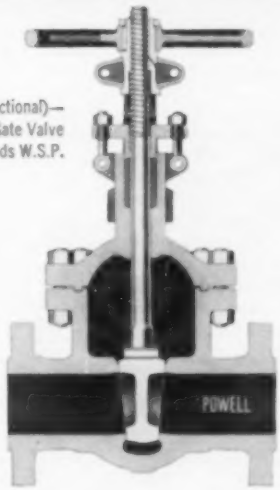


Performance-- Value...

FIG. 1561—150-Pound Steel Swing Check Valve.

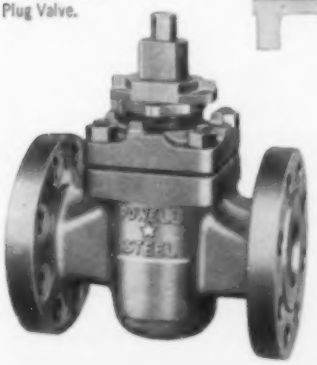
. . . POWELL VALVES . . . THE COMPLETE QUALITY LINE . . . POWELL VALVES . . .

FIG. 6003 SS (Sectional)—Alloy Steel Gate Valve For 600 Pounds W.S.P.



Powell Valves

FIG. 1559—150-Pound Steel Lubricated Plug Valve.



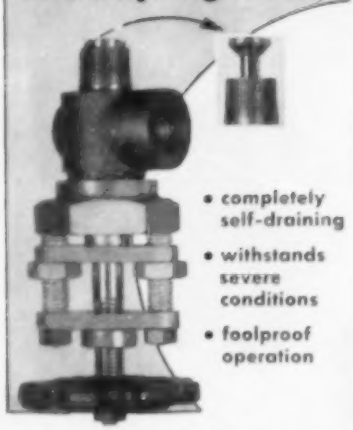
You can depend on outstanding *performance* from every valve made by The Wm. Powell Company, for Powell Valves have a proven record of long life and dependable service.

And Powell Valves give you better *value!* They're precision made and incorporate many quality features—features that can save you money and give you lasting flow control.

Consult your Powell Valve distributor. If none is near you, we'll be pleased to tell you about our *COMPLETE quality line*, and help solve any flow control problem you may have.

The Wm. Powell Company, Cincinnati 22, Ohio . . . . . 109th year

New!
Jerguson Drain or Sampling Valve



- completely self-draining
- withstands severe conditions
- foolproof operation

The new Jerguson No. 23 Drain or Sampling Valve is completely self draining, for the valve stem seats on the outside of the valve body. It is ideal for installations where it is desirable to have the valve seat inside the wall of a vessel in order to prevent the typical condition of liquid remaining in the nipple and valve inlet.

This rugged, new Jerguson Valve has outside screw and yoke construction to meet high temperature or corrosive conditions where inside threads cannot be tolerated. The efficient outside thread design eliminates possible freezing and allows the valve stem to work freely at all times. The No. 23 Valve provides foolproof operation because the stem is constructed with a left-hand thread, thus allowing the valve handle to operate in the normal direction of standard valves.

The No. 23 is recommended for pressures up to 4000 lbs. @ 100° F. or 1000 lbs. @ 750° F. Standard with ¾" N.P.T. Male inlet and ¾" N.P.T. Female outlet. Optional features include construction with an additional connection for such uses as a steaming out line, or with a reamer on the end of the stem to break away encrusted matter which may have collected on the inside vessel wall.

Write for data unit and complete details.

JERGUSON

Gages and Valves for the Observation of Liquids and Levels

JERGUSON GAGE & VALVE COMPANY

100 Fellsway, Somerville 45, Mass.

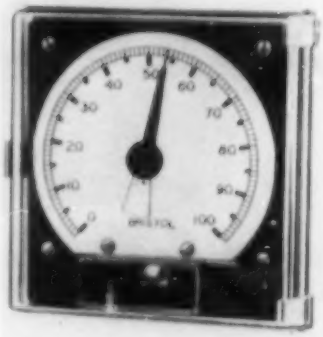
Offices in Major Cities

Jerguson Trass Gage & Valve Co., Ltd., London, Eng.
Pétrole Service, Paris, France

con. and other hard-to-solder metals, the Alcar Solder Gun does not require an external source of heat. A special heating coil within the transducer delivers heat to the working tip from a second power line contained in the one cord set.

The unit is resonant at 20 kilocycles and may be operated from Alcar's 30- or 100-watt generator. Operable from the same source is a solder pot for fluxless tinning and dipping of small parts. **Alcar Instruments, Inc.,** 17 Industrial Ave., Little Ferry, N. J.

Circle No. **13** *on Reply Card*



Miniature Telemeter Receivers

. . . **for graphic panels** indicate pressure, flow, temperature, differential pressure, or electrical measurements. They are available either as indicators or strip-chart recorders, and occupy a panel space of 5 in. square. These miniature receivers use the same standard "Metameter" time-impulse duration mechanism as the full-size models. **The Bristol Co.,** Waterbury 20, Conn.

Circle No. **14** *on Reply Card*

Low Flow Detector

. . . **with ½% accuracy** will measure over a range of 0.07 to 0.7 gpm. The unit with an a-c output signal directly proportional to flow can be used with a digital computing system, or with an electronic frequency converter. The standard sensing element housing has a ½ in. AN standard male flared tube connection for both inlet and outlet. Other type end fittings are available. The unit operates at temperatures from —300 to +450° F. Special high temperature units are available on request. **Potter Aeronautical Co.,** Route #22, Union, N. J.

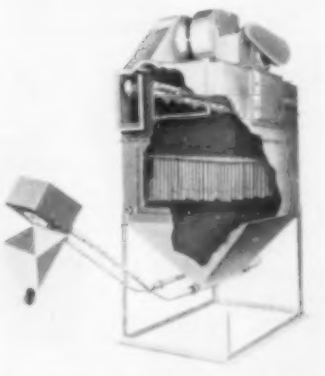
Circle No. **15** *on Reply Card*

Electronic Liquid Leveler

. . . **is portable,** and operates in any electrically conductive liquid.

This package unit includes an electronic relay, high and low level stainless steel 18-8 probes, solenoid valve, 36 inches of nickel plated copper tubing, and a brass needle valve. Operating on 115 volts, 50-60 cycle a-c, this unit will maintain bath levels within ±0.046 in. **Blue M Electric Co.,** 138th & Chatham Sts., Blue Island, Ill.

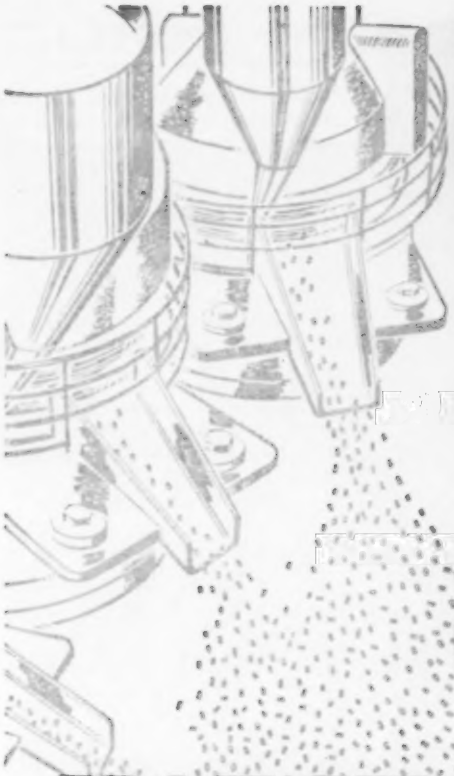
Circle No. **16** *on Reply Card*



Dust Collector

. . . **of water precipitator type** removes 99% of dust loadings at five grains/cu. ft., and 70% of the material below five-micron particle size.

Dust is collected by hydro-compressing exhaust gases through a system of multiple tubes into a water chamber. The water agitation set-up causes secondary pressure turbulence and additional scrubbing action in the tube chamber. High temperature op-



Every week Harshaw produces carloads of catalysts, and every week we produce orders of only a few pounds for customers' experimental purposes. Whether your catalyst requirement is measured in tons or pounds, we have modern facilities for giving you exactly the catalyst you want. If you are in the experimental or development stage and need only a few pounds of your catalyst, call for our technical assistance; if you are in the production stage, call on Harshaw to produce any amount of catalyst you need. Our ability to produce will provide the catalyst... when you want it. If your mind's on catalysts, call Harshaw today.

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- Spheres
- Rings
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Cleveland 6, Ohio
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It brings together the specialized engineering and manufacturing experience, and enlarged, modern production facilities of these two companies to better serve your standard and special needs.

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UNITED STATES GASKET COMPANY, Camden 1, N. J.

THE BELMONT PACKING & RUBBER COMPANY, Phila. 37, Pa.

U.S. GASKET—BELMONT PACKING PRODUCTS INCLUDE:

PACKINGS: MOLDED RINGS—Teflon, Asbestos Cloth, Duck. SPIRAL OR COIL PACKING—Braided and Twisted Asbestos, Braided Teflon, Extruded Teflon, Asbestos Fabric, Duck and Rubber, Flax and Jute, Metallic and Semi-Metallic. PLASTIC PACKING—Teflon, Shredded Asbestos, Metallic. SHEET PACKING—Asbestos, Fibre, Cork, Rubber, Synthetic Rubbers, Metallic. O-RINGS, BACK-UP RINGS, V-RINGS, CUPS, U-RINGS, FLANGE PACKINGS—Teflon, Leather, Rubber, Rubber-Reinforced. **GASKETS:** Spiralwound, Molded Teflon, Kel-F, Teflon-Jacketed, Metal-Asbestos, Asbestos, All Metal. **TEFLON SPECIALTIES:** Expansion Joints, Flexible Couplings, Adapters, Reducers, Rotating Mechanical Seals. **TEFLON & KEL-F STOCK:** sheets, tape, rods, tubing, bars, cylinders, fabricated parts.

U. S. GASKET • BELMONT PACKING

eration is possible since the dust-laden gases can be pre-wetted and cooled in the entry chamber. Solids build-up is prevented by constant flushing of the interior, and the absence of moving parts aids in low maintenance. Low water consumption results from use of a recirculating system and automatic control of makeup water.

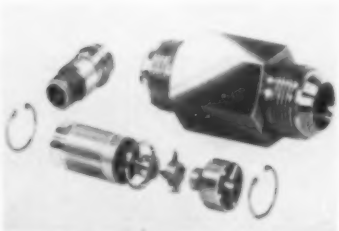
The scrubber comes in 15 sizes for capacities ranging from 500 to 40,000 cfm. Normal construction is of steel, although special metals or plastic materials can be specified. The nine smallest units are furnished assembled; the larger units are shipped in sections. **The Johnson-March Corp.,** Philadelphia, Pa.

Circle No. **17** *on Reply Card*

Pressure Controller

. . . has multiple duty, serving as pressure sensing element, control pilot and control valve. This new Micro Delta P Controller provides square-wave pressure response, microsecond control without hunting, and constant pressure throughout the full flow range. **Industrial Engineering Corp.,** 525 E. Woodbine, Louisville, Ky.

Circle No. **18** *on Reply Card*

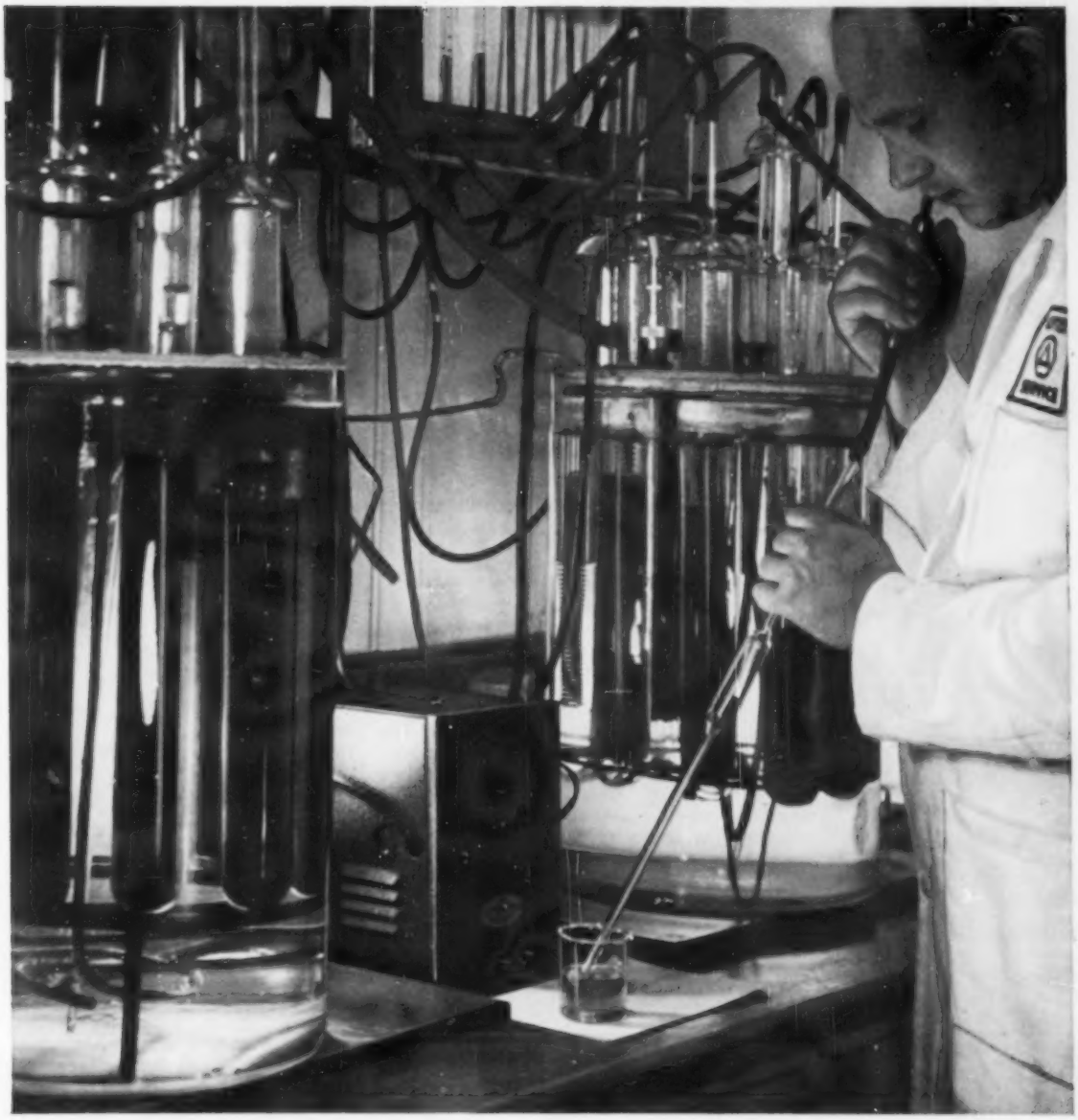


Turbine Meter

. . . records flow measurement of up to 100,000 lb./hr. at specific gravity of 1.0, and is accurate to within ± ½ %. Range is 20:1 and maximum pressure drop is 7 psi.

The meter consists of a fluid-driven

GOING PLACES *into a drop of oil with Cities Service...*

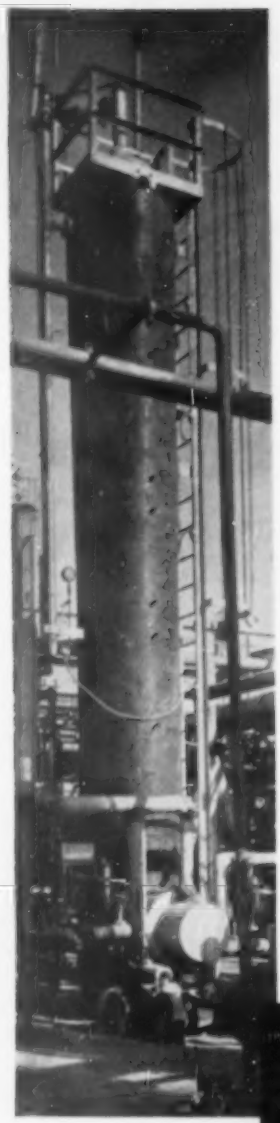


Cities Service researchers enter the minute world of the molecule and come out with new and better products . . . for example, 5-D Premium gasolene and 5-D Koolmotor oil. The superior performance of these new products has boosted sales of Cities Service gasolenes at double the rate of industry demand.

CITIES SERVICE

A Growth Company

Number 15 of a series



Your Difficult Cleaning Jobs

now quickly handled by just a single material. . . .

NEW OAKITE COMPOUND No. 85

When it comes to removing heavy soils that build up in refinery processing equipment, you no longer need two different materials: a solvent cleaner for carbon, and an acidic cleaner for iron oxides and sulphides.

Oakite now offers a new detergent, Oakite Compound No. 85. It does both jobs in one simple operation. With this one material you can remove carbon as well as iron oxides and sulphides — at a considerable saving in time and money.

Oakite Compound No. 85 is particularly recommended for cleaning and conditioning absorbers, debutanizers, de-ethanizers, feed stock preheaters, heat exchangers and stabilizers.

For complete information, write for Bulletin F-3751. Oakite Products, Inc. 50D Rector Street, New York 6, N.Y.

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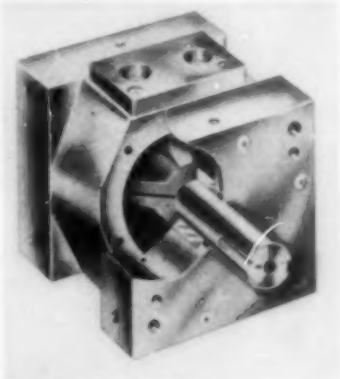
rotor mounted in a short housing installed in the pipe line. The rotor turns at a speed directly proportional to the fluid velocity. Since the blades of the rotor are of magnetic material, each blade induces an electrical pulse as it passes a pickup coil containing a magnet. The number of pulses is directly proportional to the speed of blade rotation and number of blades.

The pulse frequency of the output may be fed into a Bristol converter where it is converted to a DC voltage linearly proportional to the input. A Bristol indicating potentiometer translates the voltage level to true rate indication. Specific gravity corrections are fed manually into the potentiometer so that indicated flow rate is in mass flow units, such as lbs./hr.

Standard sizes available are ½, ¾, 1, 1½ and 2 ins., with maximum capacities from 9 to 210 gpm. **Fischer & Porter Co.,** Hatboro, Pa.

Circle No. **19** *on Reply Card*



Instant Torque Unit

. . . for up to 280° rotational movement is made possible with this new pressure operated "motor."

It eliminates complex linkage, gearing, transmissions, reduction gears, and other mechanical combinations normally required for specific applications that involve turning, opening, closing, clamping, indexing, pushing, mixing, or moving any type load or mechanism.

The device operates equally well on air, oil, water, or fire-resistant fluids and is designed for operating pressures of up to 1,500 psi. The speed of the movement is limited only by the fluid supply volume. At maximum pressure of 1500 psi, the torques obtainable vary from 1,500 to 900,000 in. lbs. for 280° rotation. If desired the torques may be increased by restricting the rotation to 100° arcs; for this rotation

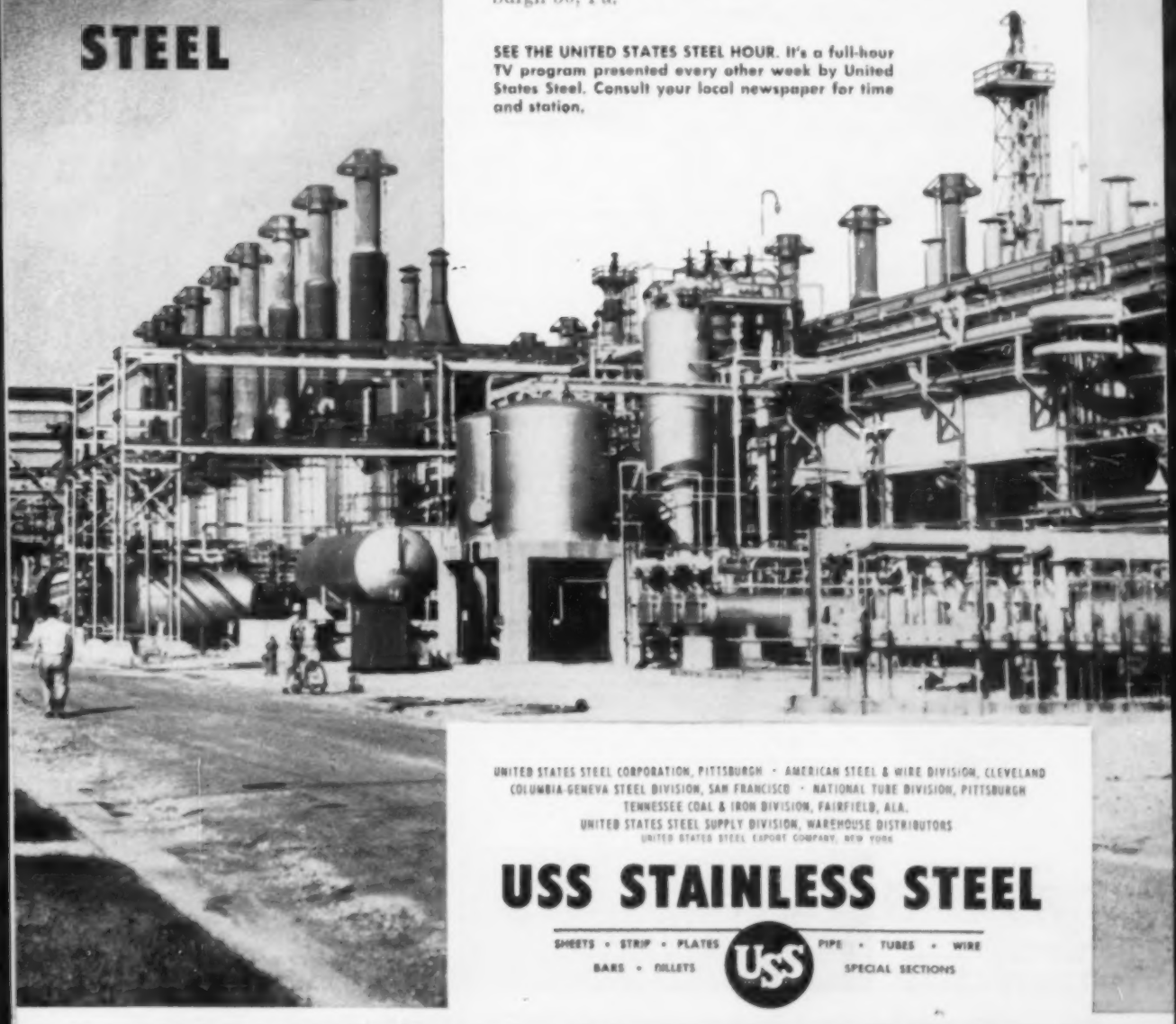
for styrene production

STAINLESS STEEL

To withstand the conditions that cause corrosion and oxidation in a big styrene plant, Stainless Steel was selected as the material for the tubes in these super heaters.

It's only one of many places where the vastly expanding petrochemical industry has met a problem of heat and corrosion with Stainless Steel. In USS Stainless Steel you have the widest variety of compositions for greatly varying applications. The ways in which USS Stainless Steel has met problems similar to those you may be encountering is described in our booklet "Performance of Stainless Steel in Petroleum Refinery Service." For your copy, write to United States Steel Corporation, 525 William Penn Place, Pittsburgh 30, Pa.

SEE THE UNITED STATES STEEL HOUR. It's a full-hour TV program presented every other week by United States Steel. Consult your local newspaper for time and station.



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COLUMBIA-GENEVA STEEL DIVISION, SAN FRANCISCO · NATIONAL TUBE DIVISION, PITTSBURGH
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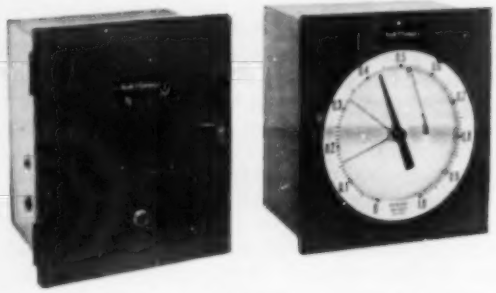
NEW SAVINGS in your operations

with

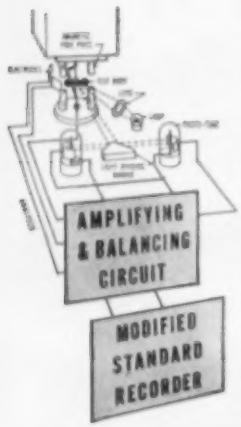
Arnold O. Beckman OXYGEN ANALYZERS



Pictured is the Model G2 Recording Analyzer—finest for precise oxygen measurement.

ON OPERATIONS LIKE THESE... MAKE SAVINGS LIKE THESE

PROCESSING AIR LIQUIFRACTION AND PRODUCTION OF HIGH PURITY GASES	*Better product quality with minimum oxygen or air contamination*
SAFETY PRODUCTION OF HYDROGEN, ACETYLENE, ETC.	*Control explosive atmospheres, reduce fire risks, minimize plant and personnel hazards*
PRODUCT PROTECTION RESIN KETTLES, COLOR PIGMENTS, PRODUCT STORAGE, ETC.	*Reduce oxidation, maintain product standards with controlled purge systems*



Unique Operating Principle

The various applications highlighted above are only a few of the many ways Arnold O. Beckman Oxygen Analyzers—industry's great new profit builders—are being used by progressive operators to boost profits, cut costs.

These are the *only* oxygen analyzers that *continuously* measure process streams by an advanced magnetic principle that provides *direct physical measurement of the oxygen itself*—not of some secondary relationship.

Heart of the unit, as illustrated, is a dumbbell-shaped test body suspended in a magnetic field. Sample gas surrounding this test body causes it to rotate in the field, depending upon the oxygen content of the gas. The movement of a light beam, reflected by a small mirror on the test body, is measured by simple electronic circuits... and the result indicated directly on a conventional recorder or indicator. It's simple, positive, accurate!

No chemicals—filaments—catalysts cams—complicated mechanical parts!

Send for Helpful Free Literature *which describes this unique operating principle in detail—explains its many advantages and applications. When writing, outline your particular operations—we'll gladly supply specific information.*

Ask For Data File 15J-125

FEATURES OF THE G2

Many ranges: Full scale ranges 0-0.1%, 0-0.5%, 0-1% O_2 and others for low O_2 concentrations. Ranges 90-100%, 95-100% O_2, etc., for high O_2 concentrations.

Multi-Ranges: Any instrument may be supplied with two or more ranges.

***Note:** For ranges wider than 0-5% O_2, ask about the Model F3 Analyzer.*

Arnold O. Beckman INC

Instruments for Science and Industry

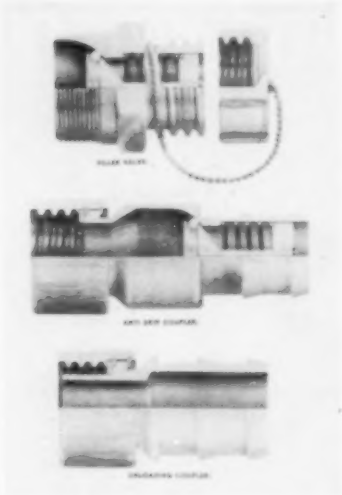
1020 MISSION STREET

SOUTH PASADENA, CALIFORNIA

the possible torques vary from 4,500 to 1,800,000 in. lbs.

The actuator is square shaped for minimum space requirements, and may be mounted on any of the six faces. **Roto-Mation Motors, Inc.,** St. Clair, Mich.

Circle No. **20** *on Reply Card*



Hose Coupler

. . . will prevent loss of tank pressure or vapor when disconnected. The coupler consists of a filler valve that is threaded into the tank, and a quick-connection coupler attached to the filling hose. When disengaged, a check valve unit in the filler cap prevents flow out of the tank. An anti-drip coupler may also be used to prevent loss from the hose when disconnecting. **James-Pond-Clark,** 2181 East Foothill Blvd., Pasadena 8, Calif.

Circle No. **21** *on Reply Card*

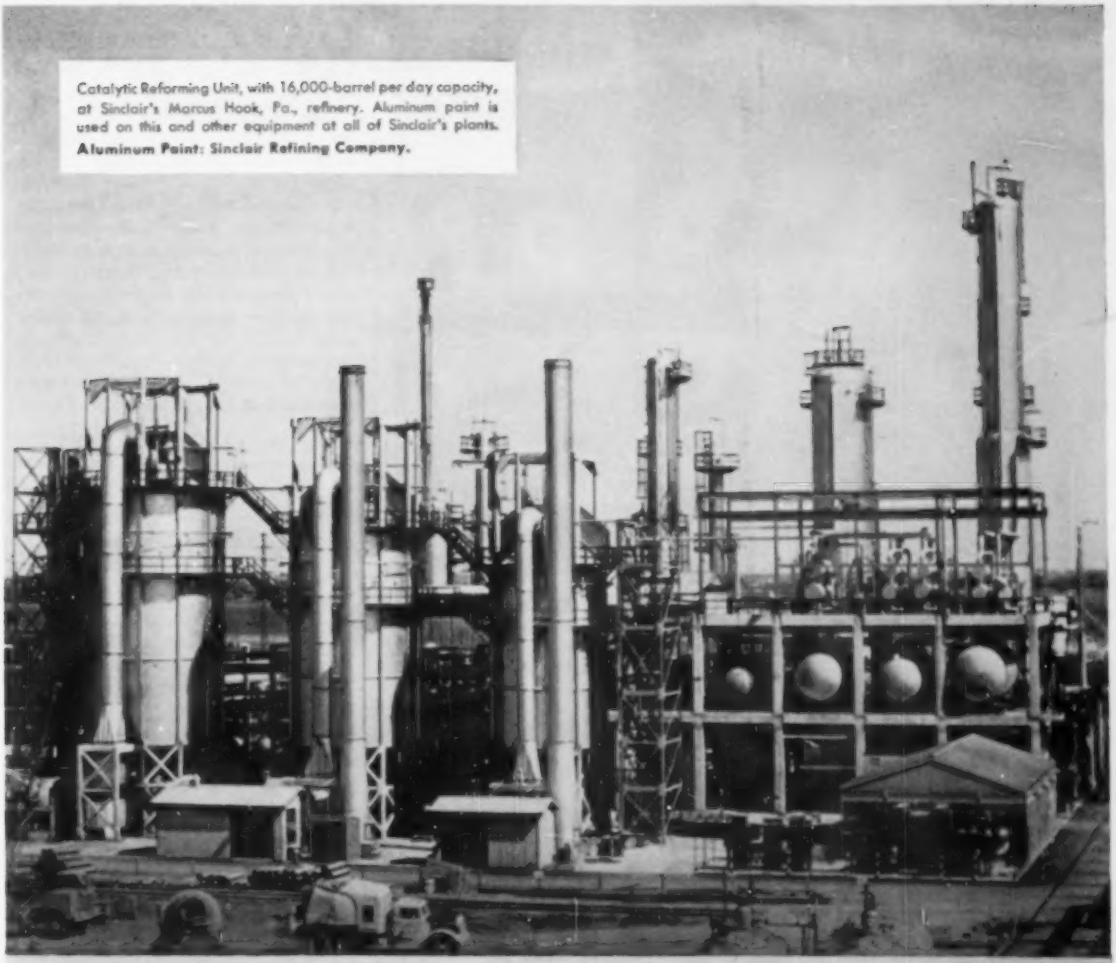
Level Alarm

. . . for explosion proof service uses a design that eliminates any need for connecting cable between the probe and relay unit. The electronic relay is actuated by electrostatic proximity effects between the probe and the surrounding media. It will operate on practically all material, whether conductive or non-conductive. **Instruments, Inc.,** 122 North Madison, Tulsa 6, Oklahoma.

Circle No. **22** *on Reply Card*

Mass Flowmeter

. . . adjusts for variations in specific gravity from 0.600 to 0.900, and meas-



Catalytic Reforming Unit, with 16,000-barrel per day capacity, at Sinclair's Marcus Hook, Pa., refinery. Aluminum paint is used on this and other equipment at all of Sinclair's plants. **Aluminum Paint: Sinclair Refining Company.**

Five good reasons why Sinclair uses ALUMINUM PAINT

Sinclair Refining Company makes extensive use of aluminum paint pigmented with ALCOA Aluminum at its vast refineries, bulk plants and terminals. The company gives five good reasons for this wide use:

1. Aluminum paint has a clean, attractive appearance.
2. Aluminum paint has excellent durability in exterior exposures.
3. Its high reflectivity turns back sun's rays, cuts evaporation losses.
4. It is economical because of its ease of application, high spreading power.
5. It is heat-resistant, able to withstand higher temperatures, without failure, longer than other types of protective coatings.

Sinclair points out an example of this heat resistance on cracking unit stacks where surface temperatures range from 500° to 900°F. Sinclair's Silicone Aluminum paint gives an excellent service record at this heat, withstands year-round weather conditions as well.

ALCOA does not make paint. But ALCOA Aluminum Pigments are used in more aluminum paints than any other brand. Look for the ALCOA label on the paint that you buy. It's your assurance of top quality pigment in the aluminum paint that you buy —paint that will protect installations throughout the petroleum industry.

Write us about your paint problems. Mail the coupon today for FREE booklet, *Painting With Aluminum*, gives the latest data on aluminum paint and how to use it.

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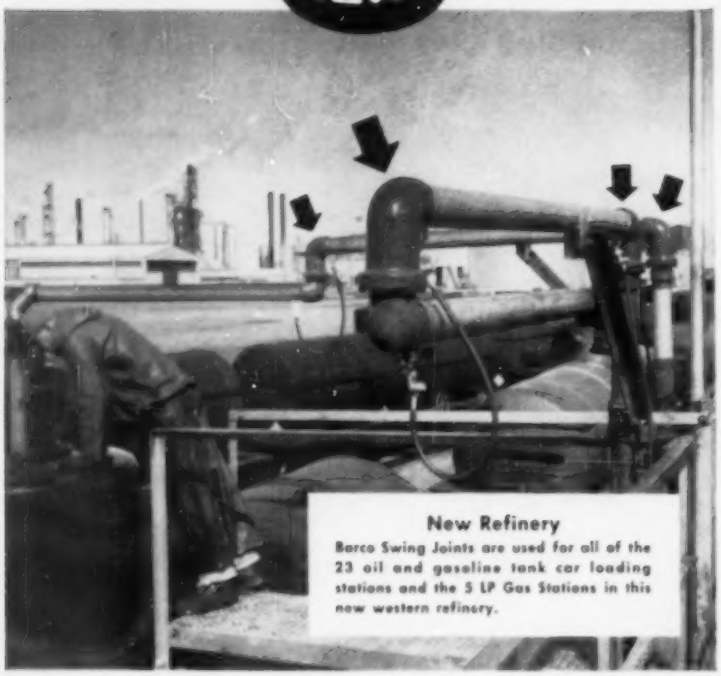
Company _____

Address _____

City _____ Zone _____ State _____

 (To obtain more data on advertised products see page 1964)

SWING JOINTS BARCO ASSEMBLIES



New Refinery
Barco Swing Joints are used for all of the 23 oil and gasoline tank car loading stations and the 5 LP Gas Stations in this new western refinery.

How Barco Makes Refinery Loading Racks Work Better!

1. **Controlled Torque**—Here is a feature users unanimously applaud in Barco's new Swing Joints—*no annoying, uncontrolled free swinging of lines.* They swing easily but stay put.
2. **Ball Bearing and O-Ring Equipped**—Designed specifically for handling gasoline, oil, lube oil, LP gas, and other fluids, including many chemicals, *without leakage.*
3. **Large Bearing Surface**—Barco's bearing design provides adequate support for lengths of piping. Minimizes bearing pressures and wear.
4. **Long Life**—New "Bar-Moly" dry lubricant process used by Barco gives a permanent anti-galling, corrosive-resistant finish to moving parts. This, combined with routine lubrication, insures longest possible maintenance-free service.
5. **Easy Maintenance**—Joints can be disassembled for inspection without disconnecting piping. O-rings are easily renewed in the field. Frequent greasing not required to maintain sealing.
6. **Custom Designed Installations**—Your Barco Representative will be glad to show you actual models of smooth-working, balanced assemblies and a wide choice of Barco custom designs. Choice of materials, including all-steel. Sizes 1", 1½", 2", 2½", 3", 4", 6", and 10"—eleven different styles of joints. Ask for Catalog 400.

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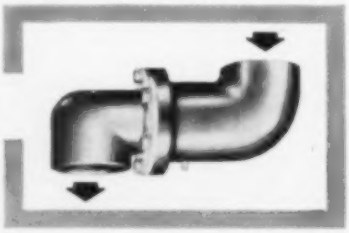
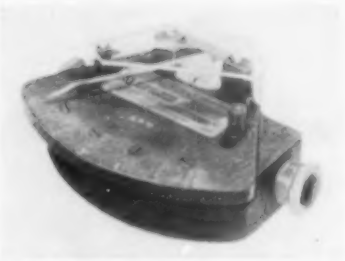
Worldwide Sales and Service



ures flow over a range of 30,000-to-1 or more.

The entire range is covered by five scales. The flow is switched automatically to the proper sensing element when the flow passes above or below the range of the element in operation. Fluid density is constantly measured by means of a detector unit, in which angular rotation proportional to density is produced. An output signal from the detector unit corrects the instrument reading for fluid specific gravity. Accuracy is within ±½% of full-scale for each of the five scales. **Potter Aeronautical Co.**, Route #22, Union, N. J.

Circle No. **23** *on Reply Card*



Direct Reading Flowmeter

. . . shows volume as well as the condition of the flowing liquid.

A flexible vane riveted to the meter body at one end, and swinging in an arc at the other end, eliminates the need for pivots, bearings, bellows, and other delicate parts. Due to the small mass of the vane and the large surface presented to the flowing medium, this simple design permits measuring flow under conditions of vibration. The transparent cover allows an operator to notice color changes, contamination, waste pick-up, or other changes in the fluid.

Model "L" (lower picture) is of the same basic design but separates the moving pointer from the line pressure. The pointer is magnetically coupled to the vane, eliminating packing glands, blind bearings, and the chance for

YOUR NAME HERE*. . . . . .

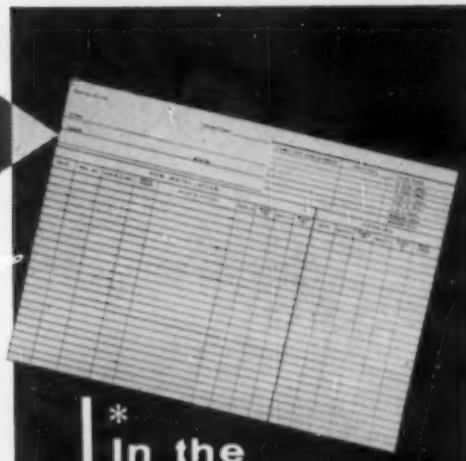
may save you time and money . . . keeps production UP

When industrial furnace enclosure repairs become necessary today, there's a lot of satisfaction in knowing that they can be made efficiently—and quickly—under the supervision of the company which designed those enclosures.

If you are fortunate enough to have Bigelow-Liptak furnace enclosures in your plant—the ehtire record of the installation; its description and lists of all repair parts are at the finger tips of our production department—ready to be used at a moment's call to help you get your furnace back in efficient operation in a minimum of time.

Experiences like the recent predicament of one of the major oil refineries prove the value of this Bigelow-Liptak feature. By means of comprehensive Trade Cards—that cover every Bigelow-Liptak installation from one end of the world to the other—recommendations were made over the telephone to this refinery which was having difficulties because war production during the last several years had forced operation to almost double its designed capacity. Necessary repair parts were indicated. A fully informed engineer was rushed to the job. And this aviation gasoline plant which had operated five years without repairs was back in service in four days at this greatly increased rating.

"Please accept our appreciation for the effort made to put this plant back in operation. It is nice to know we are dealing with companies and individuals who feel an interest and a responsibility in the jobs they have furnished," wrote the chief engineer of this great refinery. This is but one of dozens of recent tributes paid to the cooperation, engineering skill and efficient organization of Bigelow-Liptak. Your operation may depend not only on the design of the heat enclosure but the cooperation and efficient organization that backs it up.



* In the general office of Bigelow-Liptak

. . . there is a Trade Card that contains a detailed record of every installation. On this card will be found all of the data and information necessary and useful in servicing the job. Many of these cards are never referred to because Bigelow-Liptak enclosures are designed for long dependable service. But since furnace enclosures are the parts most subject to wear and tear, these records often become life savers for our customers.

When emergencies come we can quickly refer to any customer's Trade Card and find an accurate record of any installation. In a few minutes, with the aid of this information, we can set in motion the work that will enable him to get his furnace back in service in a minimum time. Your name on a Bigelow-Liptak Trade Card may save you money and invaluable time.

It will pay you to discuss your heat enclosure problem with Bigelow-Liptak—if you want enclosures that will give service and economy over a long continuous operating period. Get in touch with a Bigelow-Liptak engineer.

BIGELOW-LIPTAK *Corporation*

AND BIGELOW-LIPTAK EXPORT CORPORATION
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In Canada: BIGELOW-LIPTAK OF CANADA, LTD., Toronto, Ontario

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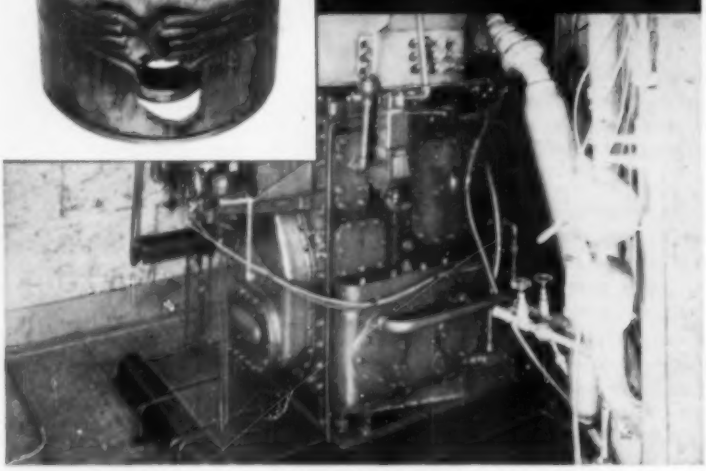
Where Oronite Lube Oil Additives helped improve aircraft oil performance

This unique Cooperative Universal Engine, equipped with a single cylinder from an aircraft engine, "flight tests" aviation oils in the laboratory. (Improperly compounded aviation oils can cause the type piston failure shown at left.)



Oronite additive research played a major role in establishing the cause and finding the solution to aircraft engine preignition from additive compounded oils. This extensive research resulted in a detergent type additive for aviation oils which will provide a marked reduction in engine deposits and wear without the hazard of preignition.

Oronite specializes in "custom-formulating" additives to your exact needs—meeting your price and performance specifications. Because of Oronite's advanced research program, elaborate testing and manufacturing facilities, Oronite's custom-compounding packs more into your oil at a given treating cost.

Why not talk over your problems with an Oronite additive specialist. Contact any Oronite office.

With Oronite Additives you can formulate oils to meet the new A.P.I. Service Classifications and can meet specifications for MIL-L-2104A, MIL-L-9000 Supplement 1 and Series 2 oils.

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Mercantile Securities Building, Dallas 1, Texas
Carew Tower, Cincinnati 2, Ohio

ORONITE CHEMICAL COMPANY

leakage. A plastic enclosure protects the moving pointer from dirt and harm.

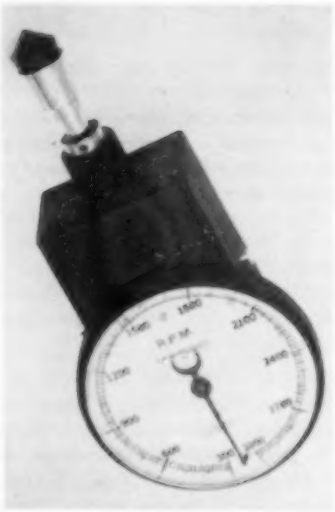
Accessories available include built-in turn cocks to regulate the flow, externally mounted stem glass thermometers, and built in bi-metal dial thermometers. **Instruments Division, Scully-Jones and Co.,** 1901 S. Rockwell St., Chicago 8, Ill.

Circle No. **24** *on Reply Card*

Plug Valve Actuator

. . . operates from only one instrument air or gas line. A built-in accumulator returns the valve to the starting position when the control air is released. This provides equalization on the diaphragm at the end of each stroke. Operating pressures required are 15 to 100 psi. of gas. **Bettis Corp.,** 320 South 66th St., Houston, Texas.

Circle No. **25** *on Reply Card*



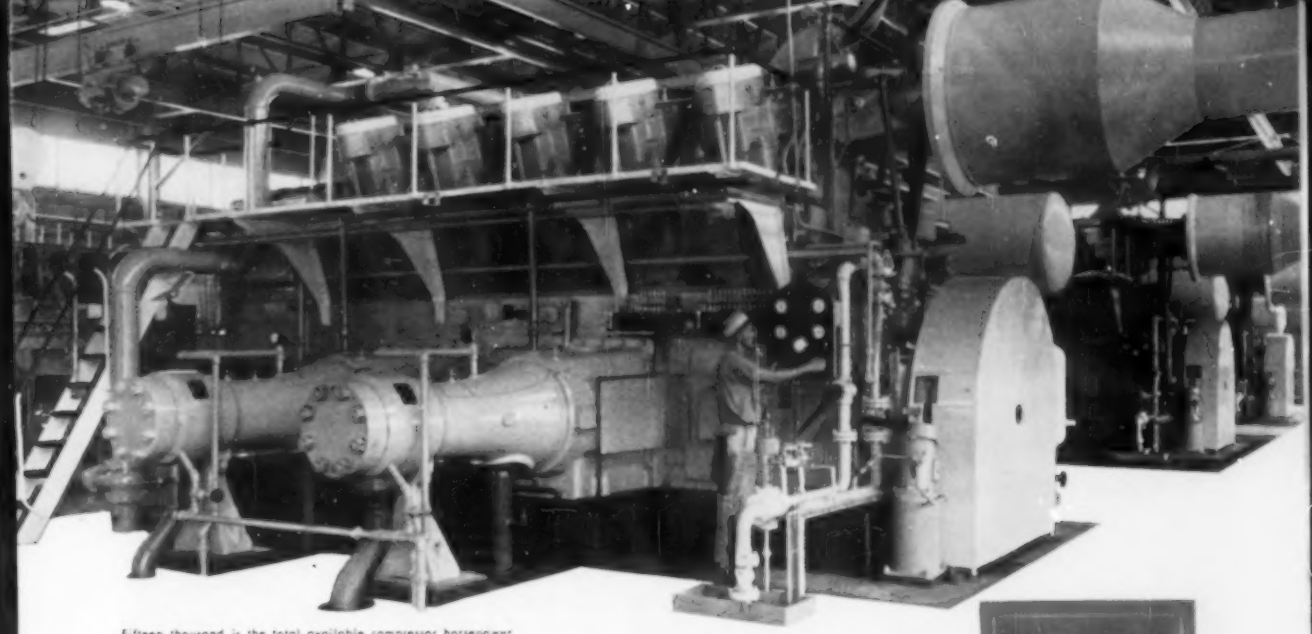
New Tachometer

. . . gives continuous readings of rotary speed. A stop button retains the valve for checking. Since the principle of operation is centrifugal-mechanical, the tachometer is not affected by temperature, moisture, electrical or magnetic conditions. Models are available in seven speed ranges, from 50 to 10,000 rpm., or 25 fpm. to 5000 fpm. **Jones Motrola Corp.,** 432 Fairfield Ave., Stamford, Conn.

Circle No. **26** *on Reply Card*

Aerosol Fire Extinguisher

. . . uses bicarbonate of soda to provide protection against spread of



Fifteen thousand is the total available compressor horsepower of six Cooper-Bessemer V-angles in operation at Lion Oil's big, modern Barton plant, not far from New Orleans.

Another Example of Efficient Power at Lower Cost

COOPER-BESSEMER V-ANGLES

"put the squeeze" on synthesis gas for a giant ammonia producer

● At Lion Oil Company's $31,000,000 Barton plant near Luling, Louisiana; six 2500 hp Cooper-Bessemer V-angle compressors have gone to work compressing huge quantities of gas for ammonia synthesis.

Operating on a day and night schedule, these engine driven Cooper-Bessemers help produce 90,000 tons of nitrogen a year in the form of anhydrous ammonia and pelleted ammonia nitrate used as fertilizer.

One major feature of the Barton plant is the compactness of compressor equipment. Important reductions in piping, foundations, installation time and building expense are made possible by utilizing only six V-angle units to deliver 15,000 compressor horsepower.

Flexibility to meet varying conditions, durability for continuous operation and efficiency for low-cost performance are three more reasons why so many Cooper-Bessemers are found in similar outstanding plants throughout the nation. The nearest Cooper-Bessemer office will gladly help you select the ideal compressor to meet your particular needs.

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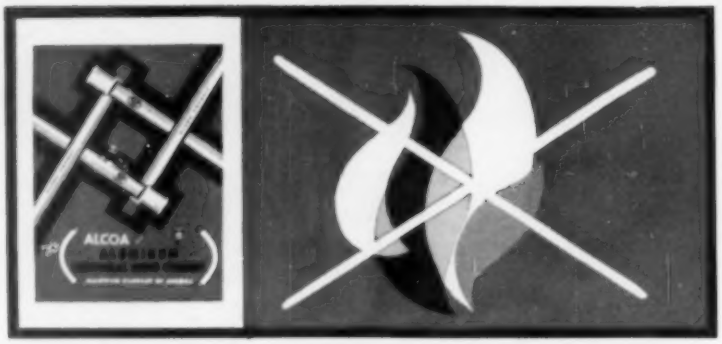
COOPER-BESSEMER

GROVE CITY, PENNA.

New York City • Seattle, Wash. • Bradford, Pa. • Chicago, Ill. Houston, Dallas, Greggton, Pampa and Odessa, Texas Washington, D. C. • Shreveport, La. • San Francisco, Los Angeles, Calif. • St. Louis, Mo. • Gloucester, Mass. • New Orleans, La. • Tulsa, Okla. • Cooper-Bessemer of Canada Ltd., Edmonton, Alberta—Halifax, Nova Scotia.

DIESELS • GAS ENGINES • GAS-DIESELS • ENGINE-DRIVEN AND MOTOR-DRIVEN COMPRESSORS



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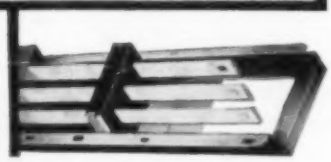

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small fires of flammable liquids or of electrical origin.

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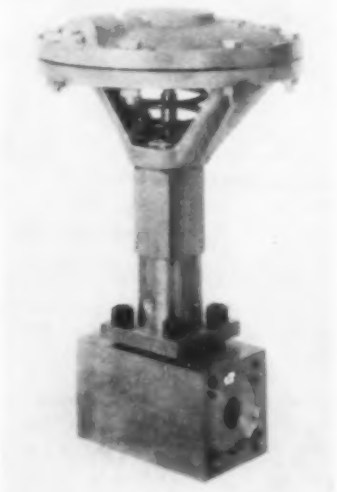
Circle No. **27** *on Reply Card*

Roller Ratchet Wrench

. . . will fit over badly burred or heavily painted nuts. It will not mar chrome fittings due to the special steel rollers, and spring expansion grip. Available in sizes from ⅜" to 1". **TKF Company,** Fisher Building, Detroit 2, Mich.

Circle No. **28** *on Reply Card*



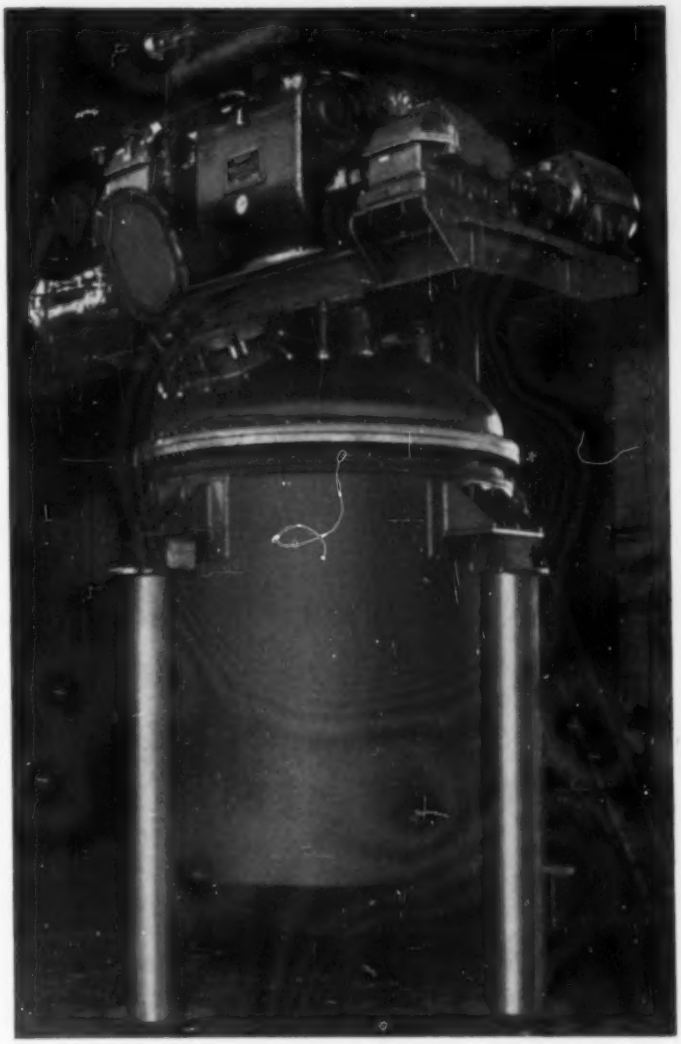
Small Control Valve

. . . is designed for hazardous flows. This "Bantam" control valve, with a bellows sealed diaphragm, has a stainless steel body and bonnet, with a

Buflovak Jacketed Grease Kettles are engineered for specific process requirements

...to fit specific processing operation needs

...to provide profitable performance



The kettle illustrated is a Buflovak Jacketed Grease Kettle with a 2500-gal. capacity. It is equipped with a compact 150-hp Cone Gear Drive for operating a Double Motion Agitator, with scrapers, to speed operation. A pneumatic discharge valve saves valuable time. It was designed and engineered by Blaw-Knox engineers to meet the specific requirements of the operation for which it was built.

We can help you solve your kettle problems. Blaw-Knox engineers have had a broad experience in designing and building kettles of every description, from the laboratory—few-gallon, capacity models to ones that process several thousand gallons—not just greases but a large number of varied products. This experience enables our engineers to incorporate in the design of each kettle all the features that are particularly applicable to the operation under consideration. Such features include size of kettle, type of body, agitators, drive, high or low temperature control, method of heating and cooling, heat source, openings and outlets, and so on.

Why not call us and let Blaw-Knox engineers make their recommendations?

A Complete Process Equipment Service

Kettles of every description constitute but one phase of Blaw-Knox Process Equipment design, engineering and fabrication service for the chemical, food, pharmaceutical, plastic and resin, petroleum, rubber and other industries: EVAPORATION • DRYING • FLAKING • MIXING • REACTION IMPREGNATING • VULCANIZING • SOLVENT RECOVERY SOLVENT EXTRACTION • CRYSTALLIZATION • DISTILLATION POLYMERIZATION • GAS CLEANING • GAS ABSORPTION • HEAT TRANSFER • VAPORIZATION • CONDENSATION • STERILIZING LOW AND HIGH PRESSURE PROCESSING

CATALOG NO. 356-R is available on request

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BUFLOVAK EQUIPMENT DIVISION
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BUBBLE CAP BULLETIN 22
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THE PRESSED STEEL CO. • Wilkes-Barre, Pa.

The names of these new Emil Greiner flowmeters tell the whole story. We believe they are the most important development in flowmeters since the invention of the rotameter. Now you can obtain complete predictability for all fluids!

Heretofore you had to do individual calibrations for each specific fluid. With the Predictability Flowmeter, you can calculate the calibration curve directly, without the need of the experimental calibration that was necessary in the past.

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Please send me Flowmeter Bulletin.

NAME _____
COMPANY _____
ADDRESS _____
CITY _____ ZONE ____ STATE _____

Teflon seating and packing above the bellows. Maximum diaphragm rating is 100 psig., with the bellows rated at 500 psig. at from —70 to 700° F. The valve assembly pictured has a special flange facing to receive a ½ in. 150 lbs., ASA raised face flange. The George W. Dahl Co., Inc., 430 High Street, Bristol, R. I.

Circle No. **29** *on Reply Card*

Free Trade Literature

Hardness, Tensile Strength

. . . of carbon and alloy steels are compared in *Technical Data Card 183*. Hardness in most common scales—Brinell, Monotron, Vickers, and Rockwell (B, C & E scales)—are related on the same chart. The Babcock & Wilcox Co., 712 Eleventh St., Beaver Falls, Pa.

Circle No. **30** *on Reply Card*

Solvent Recovery

. . . system using activated carbon is described in 36-page booklet. *Form 4410D* gives technical data on activated carbon, and its applications in the recovery of a wide variety of vaporized solvents. Carbide and Carbon Chemicals Co., 30 East 42nd St., New York 17, N. Y.

Circle No. **31** *on Reply Card*

Gravity Conservation

. . . is more than vapor conservation. *Technical Bulletin No. 510* summarizes methods commonly practiced in the oil fields for retaining the highest possible API gravity for lease fluids. Equipment and methods for preventing gravity losses are described. Black, Sivalls & Bryson, Inc., 7500 E. 12th St., Kansas City 26, Mo.

Circle No. **32** *on Reply Card*

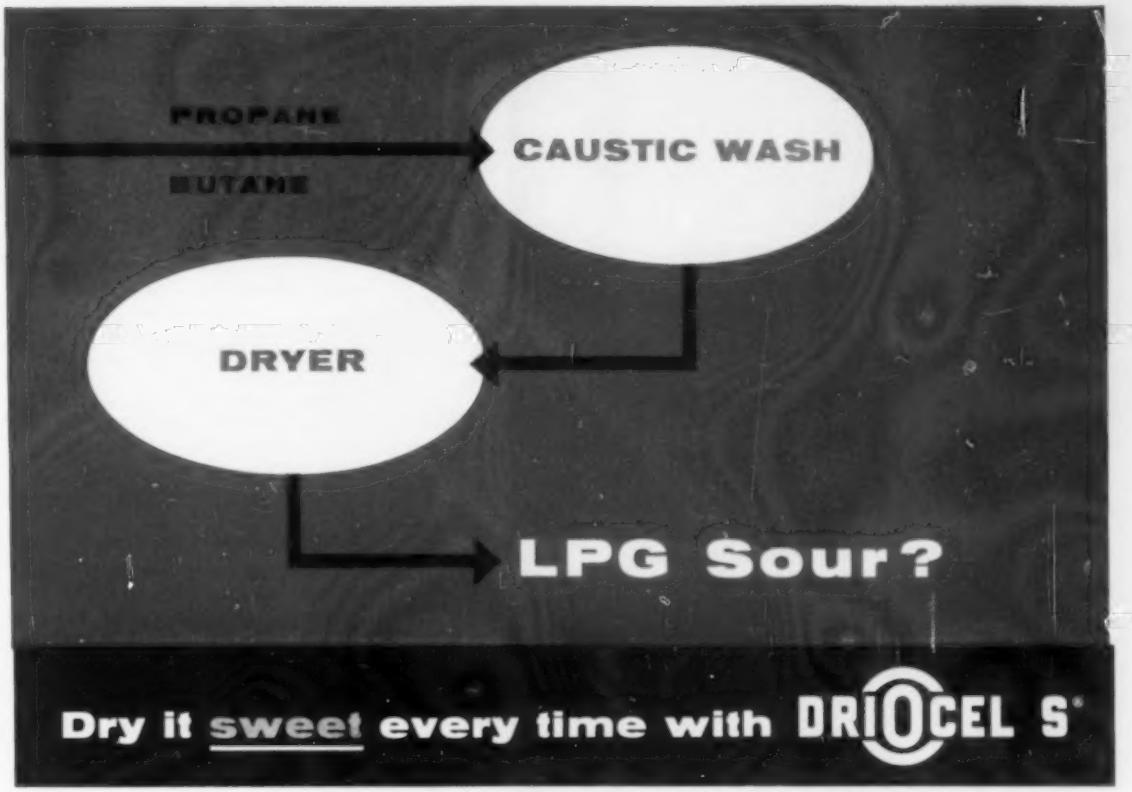
Analog-Digital Converter

. . . accepts signals from transducers, FM discriminators, FM or PWM magnetic tapes, film readers, or other analog sources. Converts them to any desired digital code. Brochure *Rea-Converter* describes this new high-speed system with a capacity of up to 100,000 conversions/sec. J. B. Rea Co., Inc., 1723 Cloverfield Blvd., Santa Monica, Calif.

Circle No. **33** *on Reply Card*

Equipment Fabrication

. . . facilities, from layout department to car loading, are pictured in *Catalog 155*. This 14-page booklet conducts a



Dry it sweet every time with DRIOCEL S®

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DRIOCEL S PERFORMS A THREE-WAY TASK.

1. It *does* a thorough job of drying the liquefied products.
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LONG SERVICE LIFE—Initial installations put on stream over two years ago are still operating.

THE SPECIFIC PROPERTIES of this new drying agent also suggest its use in the drying of chlorinated and fluorinated hydrocarbons.

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photo tour through the highspots of a 35-acre plant doing specialized metal fabricating. Fritz W. Glitsch & Sons, Inc., 4900 Singleton Blvd., Dallas, Tex.

Circle No. **34** *on Reply Card*

Atomic Energy

. . . its production, use, and applications. Described in a 44-page booklet, *The Atom In Our Hands*, is some of the interesting work being done at Oak Ridge, Tenn., and other plants and laboratories of Union Carbide and Carbon Corp. Copies are available by writing to Union Carbide and Carbon Corp., Room 308, 30 East 42nd St., New York 17, N. Y.

Do Not Use Reply Card

Control Instruments

. . . for refinery processes are described in new booklets. *Bulletin 1839* explains the principle of the Phillips process refractometer, and its applications. *Bulletin CEC 1302B* explains the operation behind the mass spectrometer, and its use in high-speed qualitative and quantitative analyses. Consolidated Engineering Corp., 300 N. Sierra Madre Villa, Pasadena 15, Calif.

Circle No. **35** *on Reply Card*

Gas and Liquid Analysis

. . . by gas chromatography is accomplished with the "Kromo-Tog." *Booklet 83* describes this self-contained instrument, using the elution method, for the separation of closely boiling isomers, determining trace components, and other analyses of organic gases and liquids. Burrell Corp., 2223 Fifth Ave., Pittsburgh 19, Pa.

Circle No. **36** *on Reply Card*

Heat Loss Graph

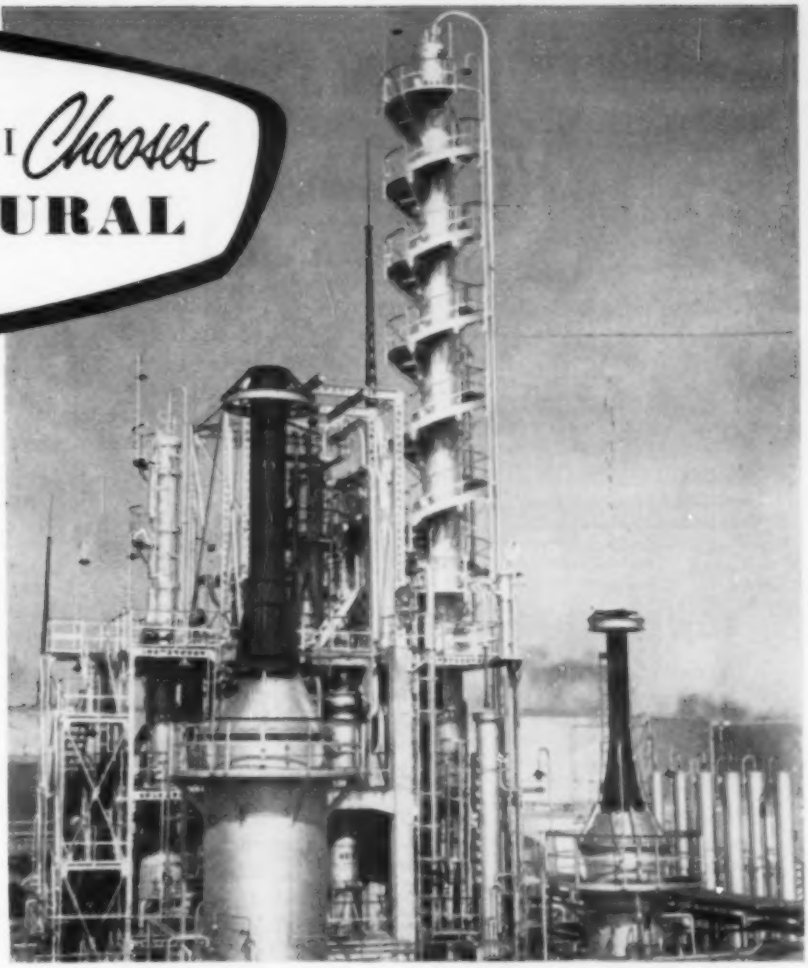
. . . eliminates calculations normally required in determining optimum application of mineral wool block and white finishing - cement insulation. Standard thicknesses of block insulation from 1 to 4 in. are plotted for hot-surface temperatures up to 1700° F. and outside surface temperatures up to 220° F. Baldwin-Hill Co., Trenton, N. J.

Circle No. **37** *on Reply Card*

Compact Gauges

. . . with 5-in. vertical scales measure pressure, temperature, draft, and differential gas pressure. *Bulletin 806* describes these self-contained measuring instruments, which may also be used

MITSUBISHI *Chooses* FURFURAL



Photograph of furfural unit in Mitsubishi's Kawasaki refinery where quality lubricating oil is produced.

why more and more oil refineries are using QO® FURFURAL

1. QO Furfural gives high yields of quality oil. The polar molecule is highly selective in its solvent action.

2. QO Furfural is readily recoverable. It is thermally stable under conditions of use and the experience of over 40 plants using furfural proves that solvent losses are low.

3. QO Furfural is readily available from raw materials which are replaceable annually.

4. QO Furfural's low freezing point of —34° F. assures trouble-free handling throughout the year.

5. QO Furfural requires no unusual precautions. It has a safety record extending over 30 years of industrial use.

For further information on QO Furfural, write for Bulletin 203-A.

The Quaker Oats Company — **CHEMICALS DEPT.**

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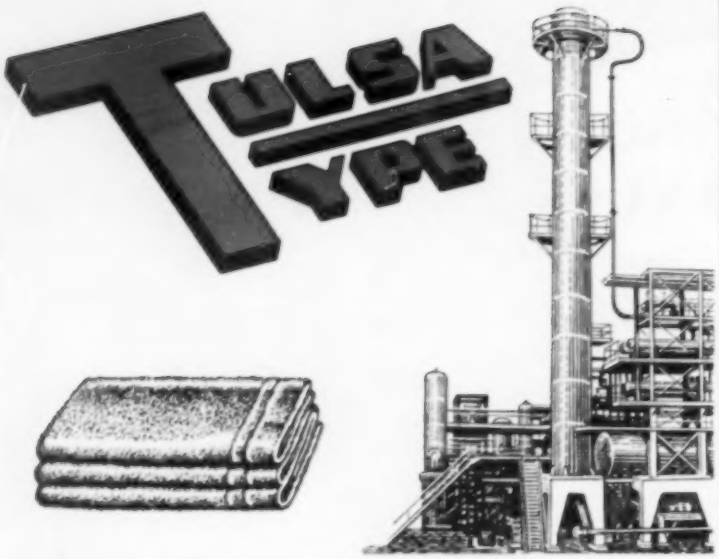
Room 539Y, 120 Wall St., New York 5, N. Y.
Room 439Y, 3000 N. Going St., Portland 11, Oregon

In the United Kingdom: Imperial Chemical Industries, Ltd., Billingham, England • In Europe: Quaker Oats-Graanproducten N.V., Rotterdam, The Netherlands; Quaker Oats (France) S. A., 3, Rue Pillet-Will, Paris IX, France; A/S "Ota", Copenhagen, S. Denmark
In Australia: Swift & Company, Pty., Ltd., Sydney • In Japan: F. Kanematsu & Company Ltd., Tokyo



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330 West 42nd Street—New York 36, N. Y.

as receivers with pneumatic transmitters. Republic Flow Meters Co., 2240 West Diversey Parkway, Chicago 47, Ill.

Circle No. **38** *on Reply Card*

Solid Lubricant

. . . of molybdenum disulfide: *Bulletin 103A* features a selector chart which describes the various carriers for this compound, temperature range, and methods of application. Alpha Molykote Corp., 65 Harvard Ave., Stamford, Conn.

Circle No. **39** *on Reply Card*

Fluid Pressure Cells

. . . convert pressure directly for electrical transmission, using strain gages in a Wheatstone bridge circuit. *Bulletin 4306*, a 16-page booklet, describes the construction and theory, the characteristics, and the instrumentation required for these pressure measuring devices. Standard cells measure from 15 to 50,000 psi; special purpose cells are available for unusual operating conditions. Baldwin - Lima - Hamilton Corp., Testing Equipment Dept., Philadelphia 42, Pa.

Circle No. **40** *on Reply Card*

Aluminum Pipe

. . . finds increasing application in process plants: 18-page booklet *"Aluminum Pipe and Fittings"* presents the information needed in considering its use. Installation techniques, fitting and valve dimensions, and a series of tables and graphs of physical characteristics of aluminum pipe are included. Aluminum Co. of America, 770 Alcoa Bldg., Pittsburgh 19, Pa.

Circle No. **41** *on Reply Card*

Using Molybdenum

. . . in industry for catalysts, pigments, and micronutrients: 28-page *Reprint Ch-15* describes the industrial applications of molybdenum chemicals in widely diverse fields. Originally these papers were presented as an American Chemical Society symposium. Climax Molybdenum Co., 500 Fifth Ave., New York 36, N. Y.

Circle No. **42** *on Reply Card*

KEL-F Lubricants

. . . oils, waxes, and greases, designed for corrosive and high temperature application: 16-page booklet, *"KEL-F Fluorocarbon Oils, Waxes and Greases,"* discusses in detail their chemical and physical properties, and their suggested applications. Chemical Manufacturing Division, The M. W.

SUN'S NEW CAT CRACKERS WILL DELIVER BTU TO B&W-

OXY-Catalyst Boilers

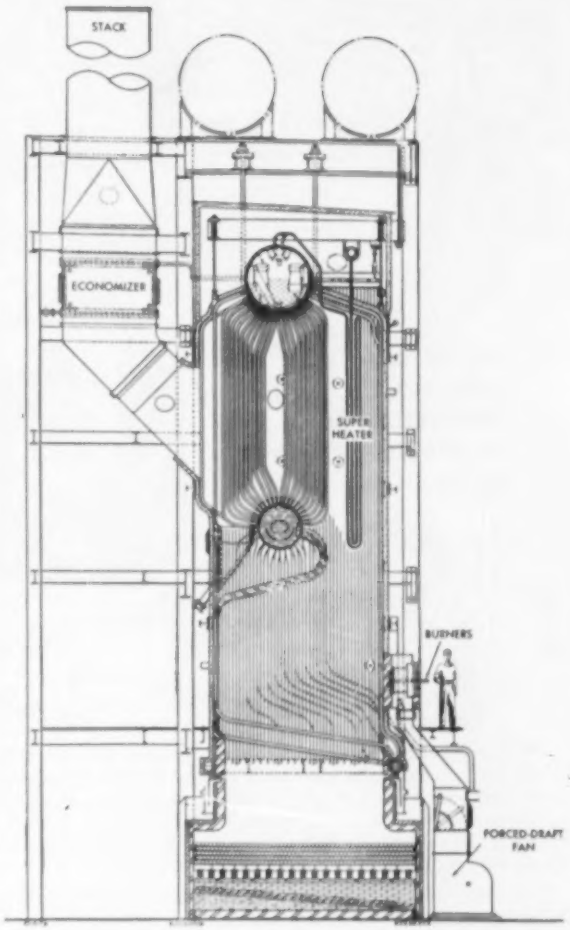
Sun Oil has undertaken an important program of efficiently utilizing the millions of Btu generated in the operation of its catalytic cracking units. Through the use of a new platinum oxidation catalyst, manufactured by Oxy-Catalyst, Inc., the combustibles in the gas streams leaving Sun's new Houdriflow units will be completely burned and the heat absorbed by B&W-Oxy-Catalyst Boilers; thus Sun Oil will save thousands of dollars annually.

Two years ago Sun installed Oxy-Catalyst elements in the exhaust gas stream of one of their fixed bed Houdry units, and proved the feasibility of using the platinum catalyst to burn the combustibles in the cracking unit exhaust gas stream.

This development work resulted in the installation of a Babcock & Wilcox Boiler in Sun's Toledo Refinery especially designed for operation with an Oxy-Catalyst bed. The B&W-Oxy-Catalyst Boiler absorbs the heat from a new Houdriflow cracking unit exhaust gas stream after the combustibles in this stream have been completely burned in the Oxy-Catalyst bed. This unit went on stream in May 1955. A duplicate unit has been completed at Sun's Marcus Hook, Pennsylvania, Refinery, and started operation June 1955.

The Sun Oil Company is spending large sums in its efforts to prevent air contamination and to recover valuable heat otherwise lost to the atmosphere in the air used for catalyst regeneration. The Babcock & Wilcox Company is happy to work with the Sun Oil Company and Oxy-Catalyst, Inc., in this new development which not only accomplishes important fuel savings but also establishes control over the discharge of contaminants to the atmosphere.

The boilers just described are the first of their kind to be installed. Sun Oil also placed one of the first B&W "CO" boilers in operation early in 1954. These boilers burn the combustibles in cracking unit exhaust gas streams by burning supplementary fuel to maintain the proper temperature for combustion in their furnaces. The Babcock & Wilcox Company, therefore, is prepared to quote on and build all types of cracking unit exhaust gas boilers, conventional waste heat, Oxy-Catalyst Boiler or CO Boiler, whichever is necessary to meet your steam and process requirements.



SECTIONAL VIEW OF THE CO BOILERS AT TOLEDO AND MARCUS HOOK

BABCOCK & WILCOX

BOILER DIVISION

G-720

It's a safe bet you WILL... with an AIRETOOL Tube Expansion Control System

Nothing beats betting on a *sure* thing! And that you do when you rely on the Airetool tube expansion control system. Automatic, the Airetool system with its preset control quickly rolls joints to a uniform tightness. Gives maximum bonding between tube and sheet. Over-rolling is, therefore, eliminated . . . and rolling time is notably shortened, from hours to minutes.

Motors are available in four sizes to supply proper power for your purpose. Entire system is portable.

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"There's an Airetool Tube Cleaner and Tube Expander for Every Type of Tubular Construction."

Kellogg Co., P. O. Box 469, Jersey City 3, N. J.

Circle No. **43** *on Reply Card*

Corrosion Resistant

. . . equipment of new materials, featured in 32-page catalog: *CEC Reprint C-12* describes complete line of equipment molded from polyvinyl chloride, epoxy glass, and polyester glass. Data on resistance to chemicals and heat, plus information about the cements for field servicing of this equipment, are included. Haveg Corp., 900 Greenbank Road, Wilmington 8, Del.

Circle No. **44** *on Reply Card*

Dessicant Dryers

. . . for air, gases, and liquids: 40-page *Bulletin No. D-100* explains the 26 principal variables of dryer design, and the effects temperature and pressure have on the size needed for specific applications. Selection charts aid in selection of required dryer. An Engineering Reference Data section presents charts and tables related to dessicants, pressure drop, gas velocity, and temperature. C. M. Kemp Manufacturing Co., Baltimore, Md.

Circle No. **45** *on Reply Card*

Laboratory Supplies

. . . including instruments, glassware, furniture, apparatus: *Supplement to Catalog 111* describes in over 100 pages the items available, and added to Fisher stocks since 1952 publication of the main catalog. A later *Chemical Index* will separately list the reagents available. Fisher Scientific Co., 717 Forbes St., Pittsburgh 19, Pa.

Circle No. **46** *on Reply Card*

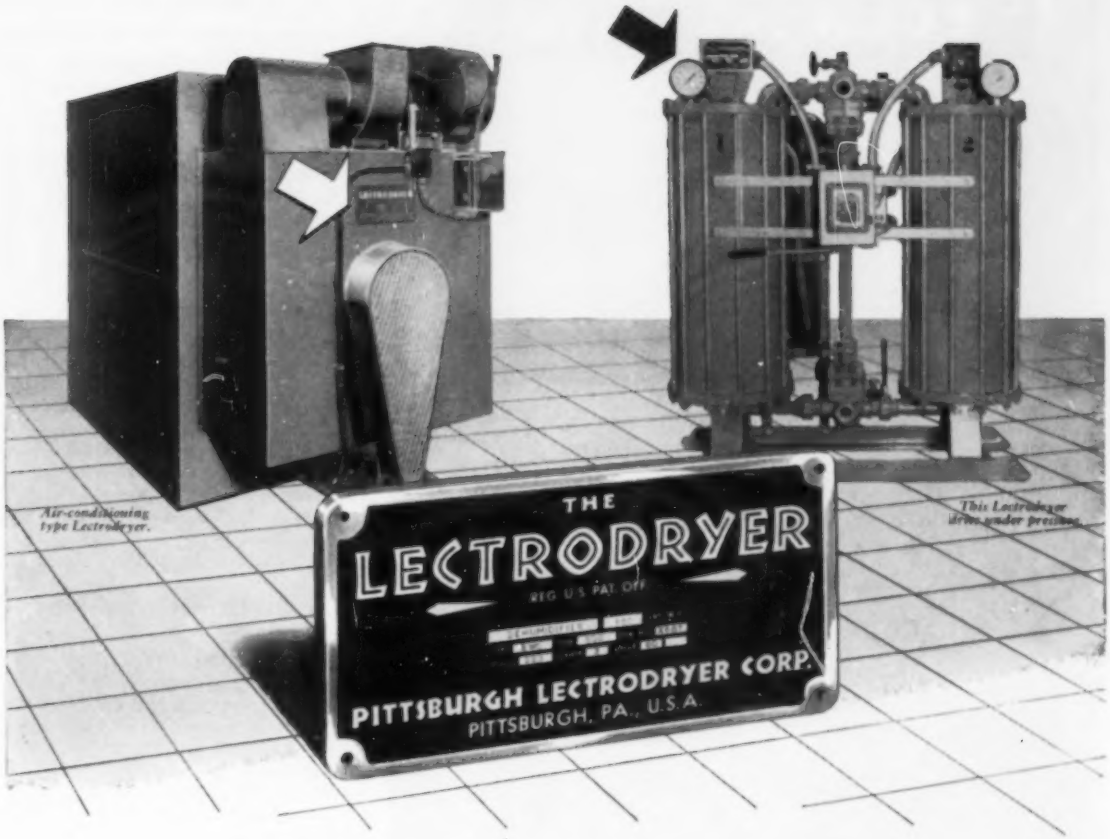
Did You Miss These?

The following items, reviewed originally in September, have aroused considerable interest among the readers. They are repeated briefly as a service to those who might have missed them the first time they appeared. For details or literature, please use the regular Reply Card in this issue.

Waste Heat Catalyst

. . . allows Sun Oil Co.'s two new Houdriflow catalytic crackers—one at Toledo, Ohio, and one at Marcus Hook, Pa.—to burn their own flue gases.

The waste-heat boiler catalyst is "Oxycat," developed by Eugene J. Houdry who first developed catalytic cracking about 20 years ago. Each Oxycat is a brick-size structure con-



Air-conditioning type Lectrodryer.

This Lectrodryer dries under pressure.

Trademark for dehumidifiers

YOU SEE dehumidifiers bearing this familiar nameplate—Lectrodryer*—in thousands of plants all over the world, in almost every industry. Ever since 1932, they have been helping to speed output and maintain high product quality by removing unwanted moisture to uniformly low dewpoints.

LECTRODRYER is the name of a large family of DRYing machines. They DRY air, gases and organic liquids. They range in size from the tiny Laboratory model, capable of handling a few cubic feet per hour, to giant wind tunnel installations DRYing tons of air per minute. They work from atmospheric pressure to as high as 6,000 psi.

Twenty-three years of DRYing experience is yours, when you consult with Lectrodryer engineers. Recommendations on plant layout, controls and other auxiliary equipment are all co-ordinated with the type and size of Lectrodryer prescribed for the job. You save time and money, and are assured of most efficient operation.

Remember the word LECTRODRYER when you need DRYing help. For a free copy of the book, *Because Moisture Isn't Pink*, write Pittsburgh Lectrodryer Corporation, 332 32nd Street, Pittsburgh 30, Pennsylvania.

In England: Birlec, Limited, Tyburn Road, Erdington, Birmingham.
In France: Stein et Roubaix, 24 Rue Erlanger, Paris XVI.
In Belgium: S. A. Belge Stein et Roubaix, 320 Rue du Moulin, Brossoux-Liege.

LECTRODRYERS DRY WITH ACTIVATED ALUMINAS

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EC&M 2200-5000 VOLT

MOTOR STARTERS

Pay off!

with ❶ **CERTIFIED 50,000 KVA interrupting capacity**

❷ **Oil-immersion for corrosion protection**

❸ **Dependable, low-cost operation**

In tank farm, gathering station, and pipeline pumping station applications, EC&M high voltage motor starters have earned a reputation for dependable, low-cost operation.

EC&M starters are virtually trouble-free, oil-immersion keeps working parts well lubricated . . . protects against corrosion. And, being automatic push button type, these starters make it easy for a station attendant to start or stop the motor-driven pumps as required.

In prominent oil centers, EC&M 2200-5000 volt motor starters are recognized for their efficiency and long life.

Investigate them today!

Write for Booklet 1062

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4498 Lee Road Cleveland 28, Ohio

6079

sisting of 71 slender porcelain rods suspended between two square porcelain end plates. A thin catalytic coating on the rod oxidizes the carbon monoxide and hydrocarbon oil vapors in the cat cracker exhaust to form a clean effluent of carbon dioxide and water vapor. **Oxy-Catalyst, Inc.,** Wayne, Pa.

Circle No. **47** *on Reply Card*

Steel Dictionary

. . . of terms of particular value to those using cold finished steel bars: 32-page *Helpful Data Bulletin No. 6*, entitled "Simplified Steel Terms and Engineering Data," includes more than 180 detailed definitions frequently used in the purchase, manufacture, treating, machining, and finishing of steel. LaSalle Steel Co., Chicago 80, Ill.

Circle No. **48** *on Reply Card*

Automatic Programming

. . . to make the computer do much of the actual work of instructing itself, thus reducing the time-consuming task of coding, writing, and checking instruction programs for computer operations: bulletin *Automatic Programming Turns Months into Minutes* describes the concepts of programming and automatic programming for electronic computers. Remington-Rand, Div. of Sperry Rand Corp., 315 Fourth Ave., New York 10, N. Y.

Circle No. **49** *on Reply Card*

Continuous Gas Sampler

. . . replaces spot sampling methods. The "Arcco-Annubis Model 100-7" accumulates, over seven days, at a constant rate to give a sample of near 100 psig from a sample source not less than 125 psig. Constant rate of gas pressure increase in the sampler—from 0 to the desired final pressure—gives a continuous gas flow rate into the sampler. **American Recording Chart Co.,** 3113 E. 11th St., Los Angeles 23, Calif.

Circle No. **50** *on Reply Card*

F'ow Meter

. . . provides direct visual flow rate indication in circulating, lubricating, and fueling systems. The "Revere F-8110" weighs 1½ lb., and is designed to cover a flow range of 7 to 70 gph at temperatures of —65 to +160° F. The unit has only one moving part and is accurate to within ±2% of the specified flow rate and has a low pressure drop. **Revere Corp. of America,** Wallingford, Conn.

Circle No. **51** *on Reply Card*

BETZ • *A Great Name In Water Conditioning*

Welcome visitor...

The Betz District Engineer is a welcome visitor wherever he goes. As our personal representative to industrial plants, petroleum installations, institutions . . . plants like yours, he plays an all-important role in our continuing efforts to engineer *controlled* water conditioning.

His job carries many responsibilities. For example, he

. . . instructs your plant operators in Betz-engineered water conditioning control techniques (chemical feed, water testing, chemical adjustment, blowdown control, etc.).

. . . makes regularly scheduled visits to your plant to review operating conditions.

. . . reviews plant control and offers "on-the-spot" constructive criticism and advice.

. . . checks testing procedures, test solutions and chemical feed equipment.

. . . inspects plant equipment and visually observes the results obtained.

. . . discusses any and all water problems with you and your operating personnel.

. . . prepares and submits a complete written report before leaving your plant.

And equally important, he works closely with the Betz headquarters engineering staff to assure the individual attention required for sound, economical water conditioning.

Next time a Betz District Engineer calls, ask him to explain how Betz *completely-integrated* water conditioning service can obtain results in *your* plant. He'll be happy to give you the details.

W. H. & L. D. BETZ, Gillingham & Worth Streets, Philadelphia 24, Pa. In Canada: BETZ Laboratories Limited, Montreal 1.

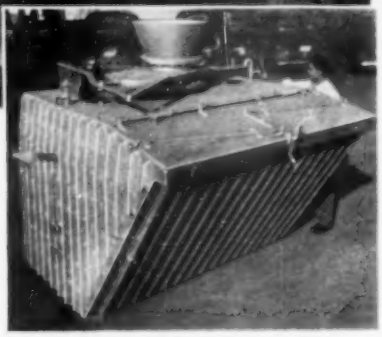
BETZ

CONSULTANTS ON INDUSTRIAL WATER PROBLEMS

(To obtain more data on advertised products see page 1964)

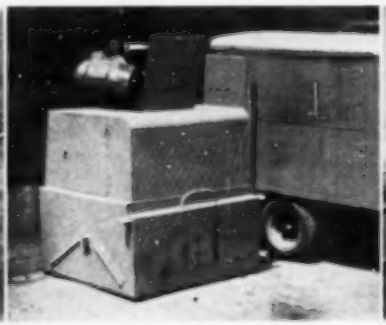
These save

Dempster-Dumpster serving a 6 cu. yd. container with cooling fins for handling a high temperature product.

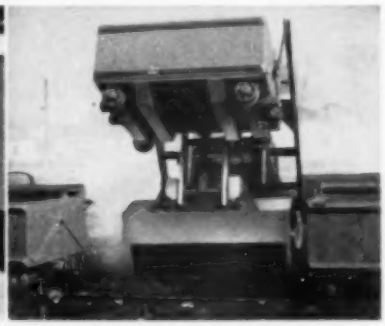


Here are a few of the hundreds of Detachable Containers we have built to solve handling problems of every description. A few others not shown include those with compartments . . . with insert containers . . . fully-insulated . . . lined with lead . . . lined with fire brick . . . with windows and doors . . . with casters . . . flat bottoms and open at one end . . . with teeth . . . with shelves for tools and supplies—and we could describe hundreds more, all served by one Dempster-Dumpster and only one man, the driver.

This 3 cu. yd. Container has skids for fork lift truck transfer.



10 cu. yd. Container widely used for refuse and combustible wastes.



Flanged wheel equipped containers for remote loading.

5178

DEMPSTER

4 manufacturers to $82,000.00 annually handling waste materials!

These four industrial plants expect to save, in labor costs alone, during the first five years service of the Dempster-Dumpster System—

A PLASTICS PLANT: $26,958.00 savings on an investment of $9,523.50 in Dempster-Dumpster equipment. Savings alone pay for equipment in two years.

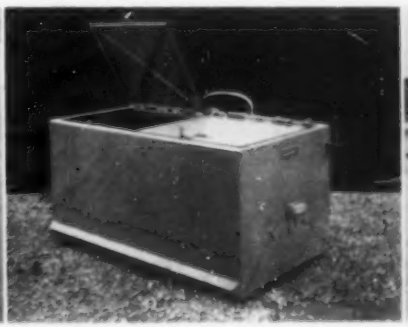
A CHEMICAL PLANT: $204,076.75 savings on an investment of $40,968.00 in this equipment . . . savings pay for equipment in one year.

AN AUTOMOTIVE PLANT: $135,000.00 savings on an investment of $19,272.00 . . . savings pay for equipment in 9 months.

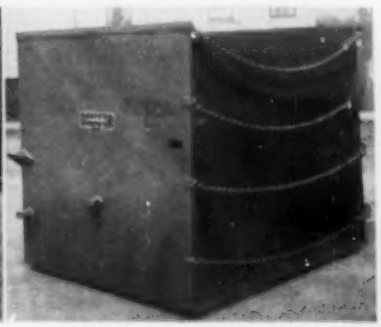
A PAPER AND PULP MILL: $43,104.00 savings on an investment of $10,750.00 . . . savings pay for equipment in 1¼ years.

Those are typical examples. Visualize a Dempster-Dumpster, operated by only one man, the driver, serving scores of big steel containers, one after another, in your plant. Containers of many designs and types, handling waste or salvable materials, raw or finished products, fluids including acids, combustibles, dusty materials—anything that can be handled in up to 21 cu. yd. detachable Dempster-Dumpster Containers . . . payloads up to 19 tons. Savings are tremendous! Take advantage of our free engineering service, which determines by fact-finding survey the cost cutting possibilities of this system in your plant. Dempster Brothers, Inc.

600 Gal. stainclad tank with brine cooling channels.



A Container available up to 10 cu. yds. with or without lids for many uses.



A 9 cu. yd. container for handling packaged products.

BROTHERS 5125 Dempster Building, Knoxville 17, Tenn.

EDITORIALS . . .

How to Get More Scientists

SHELL OIL CO. has come up with a novel approach to the shortage of graduate scientists.

A basic cause of this shortage, it claims, is a dangerous cutback in science teaching at the high school level. Figures Shell has compiled show that the number of high school students studying algebra has dropped from 56% in 1900 to 24% today. Likewise, geometry students have dropped from 27% to 11%, physics students from 19% to 4.3%.

And back of this, says Shell, is a shortage of science teachers. Last year, surveys show, American colleges turned out 57% fewer high school science teachers than in 1950, and 51% fewer mathematics teachers.

To help solve the problem, Shell—working through its Shell Companies Foundation, Inc.—has set up a program of fellowships for high school teachers of science and mathematics. Through this program, Shell will underwrite summer seminars at Stanford and Cornell Universities for 60 teachers a year. The Fellowship recipients will receive travel allowances, all tuition and fees, living expenses on the university campus, and $500 in cash to make up for the loss of potential summer earnings.

Basically, the program seeks to inspire those science teachers who, in turn, can inspire the scientists and teachers of tomorrow. The seminar programs will include graduate-level classes, lectures by outstanding scientists, and visits to modern industrial plants and research laboratories.

To the best of our knowledge, Shell is the first oil company to support high school science teaching in any such manner. We like the idea.

Throw Out That Dog

WE sometimes wonder how much further refiners can go in the motor fuel field. We've got catalytic cracking and catalytic reforming—to mention the mainstays—and we're able to supply the motorist with some fuels that approach pretty close to 100 octane. We can probably go a bit over 100 with the plants and methods we have today—but not very far and not in the volumes in which we are now making premium fuels. It's pretty much agreed that we're approaching the limit.

So what does the future hold? Where will the higher octanes come from? How will we get them? What new processing techniques are in the wind?

Some interesting answers on where we might be going were brought out at the recent meeting of the Western Petroleum Refiners Assn. in El Dorado, Ark. During one of the sessions there it was suggested that we're just about on the verge of opening up a whole new picture in refinery processing—running our catalytic crackers at high conversion levels of 70-75%, reforming at lower severities, making greater use of alkylation, and isomerizing n-pentane to iso-pentane.

It's that last item—isomerization of n-pentane—which seems to offer the biggest chance for further upgrading of gasoline quality. N-pentane has a clear Research octane rating of about 60. It is probably the most important single component which degrades gasolines today.

Iso-pentane, on the other hand, has a clear Research rating of about 90. So the value of isomerization is quite apparent. Such a step may not be too far off, either.

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to go to get that dog—n-pen

Plane Facts About A

GOOD news has been rec
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His point is that nuclear-powered planes, at least for some time, will be used for specialty services—e.g. as tanker aircraft for refueling other planes in flight. Such a tanker, which would consume none of the gasoline or jet fuel it carried, would permit our regular bombers and fighters to fly much farther—even to the point of letting us do away with some overseas bases.

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So don't go out and cancel all your plans for those new units to make avgas and jet fuel. You'll still need them.

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One of the process development firms is said to have designed and built a reformer which can be run to combine isomerization of n-pentane with the unusual reforming reactions over a platinum catalyst. Higher pentane conversions can be achieved, however, with separate isomerization than in the combined process.

We're assuming, of course, that automotive engines which need a gasoline-type fuel will still be built, and that the fuel quality will continue to increase. Maybe the automotive gas turbine will come along and bring fuel qualities back down to saner levels. But on the chance that it doesn't, the industry would do well to give some thought to the question of how far it wants to go to get that dog—n-pentane—out of its gasoline.

Plane Facts About Atomic Fuel

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So don't go out and cancel all your plans for those new units to make avgas and jet fuel. You'll still need them.

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Above photograph courtesy of QUAKER STATE OIL REFINING CORP.

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